Technical Report

of the

AMERICAN ORDNANCE ASSOCIATION

MINUTES OF EIGHTH ANNUAL MEETING

ENGINEERING DOCUMENTATION SECTION

At The Daytona Plaza Hotel
Daytona Beach, Florida
April 27 through April 29, 1966

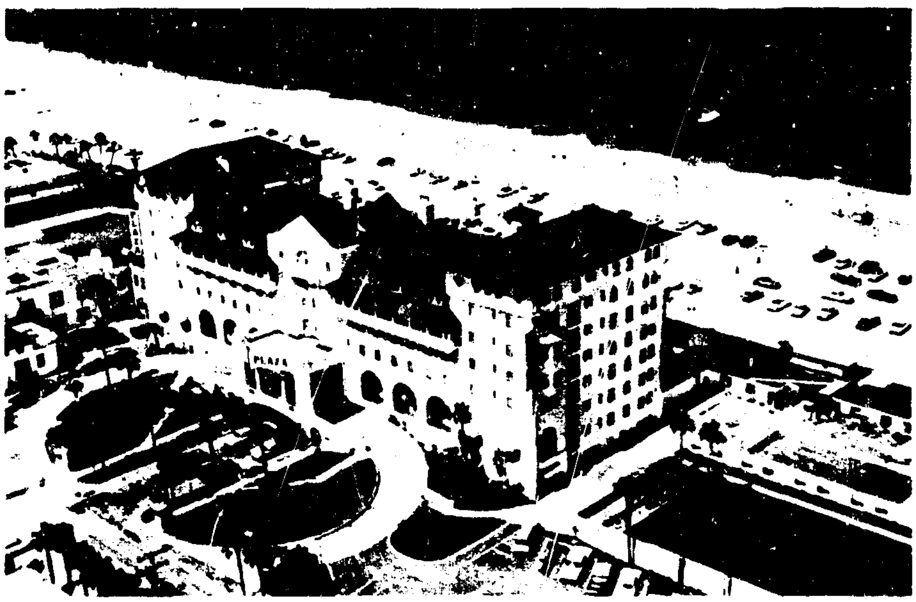
AMERICAN ORDNANCE ASSOCIATION
NATIONAL HEADQUARTERS: Transportation Building, Washington 6, D. C.

Best Available Copy

MINUTES OF EIGHTH ANNUAL MEETING OF THE

ENGINEERING DOCUMENTATION SECTION

AMERICAN ORDNANCE ASSOCIATION



Held At

At The Daytona Plaza Hotel

Daytona Beach, Florida

April 27 through April 29, 1966

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JUNE 1966

ENGINEERING DOCUMENTATION SECTION

STATEMENT OF AIMS AND PURPOSES

The Engineering Documentation Section, Production Techniques Division of American Ordnance Association, has been formed to provide to the military a group of experienced and responsible administrators from industry who may assist in the formulation of military requirements in the general area of engineering documentation administration.

While the primary purpose of the group is one of service to the Department of Defense, there is unquestionably a secondary benefit. The participants gain a greater professional insight into the needs of Government and the interpretation of military specifications. In addition, regular association with others who have similar interests provides stimulation which contributes toward success of the individual in his daily work as well as result in improvement of the overall design documentation picture for the companies with whom they serve.

The Engineering Documentation Section is made up of selected members of the American Ordnance Association who have broad experience and responsible assignments in industrial and military engineering documentation administration. The members participate as individuals rather than representatives of the companies with whom they are associated.

Action may be taken on any particular subject -- be it studies not yet sufficiently crystallized for military assignment, or specific assignments in work as a result of requests from the military. Once a subsection has been established to study a problem, participation thereon is completely voluntary. Thus only those experts with a sincere interest in a particular subject are brought together to work on it.

Duplication of the effort of other technical and industrial associations is avoided to every practical extent. There is slight duplication of internal effort since the formal meetings of the entire section include status reports on all subjects in work. These reports are only intended to keep our section members fully informed, alert, and interested in National Defense problems and procedures.

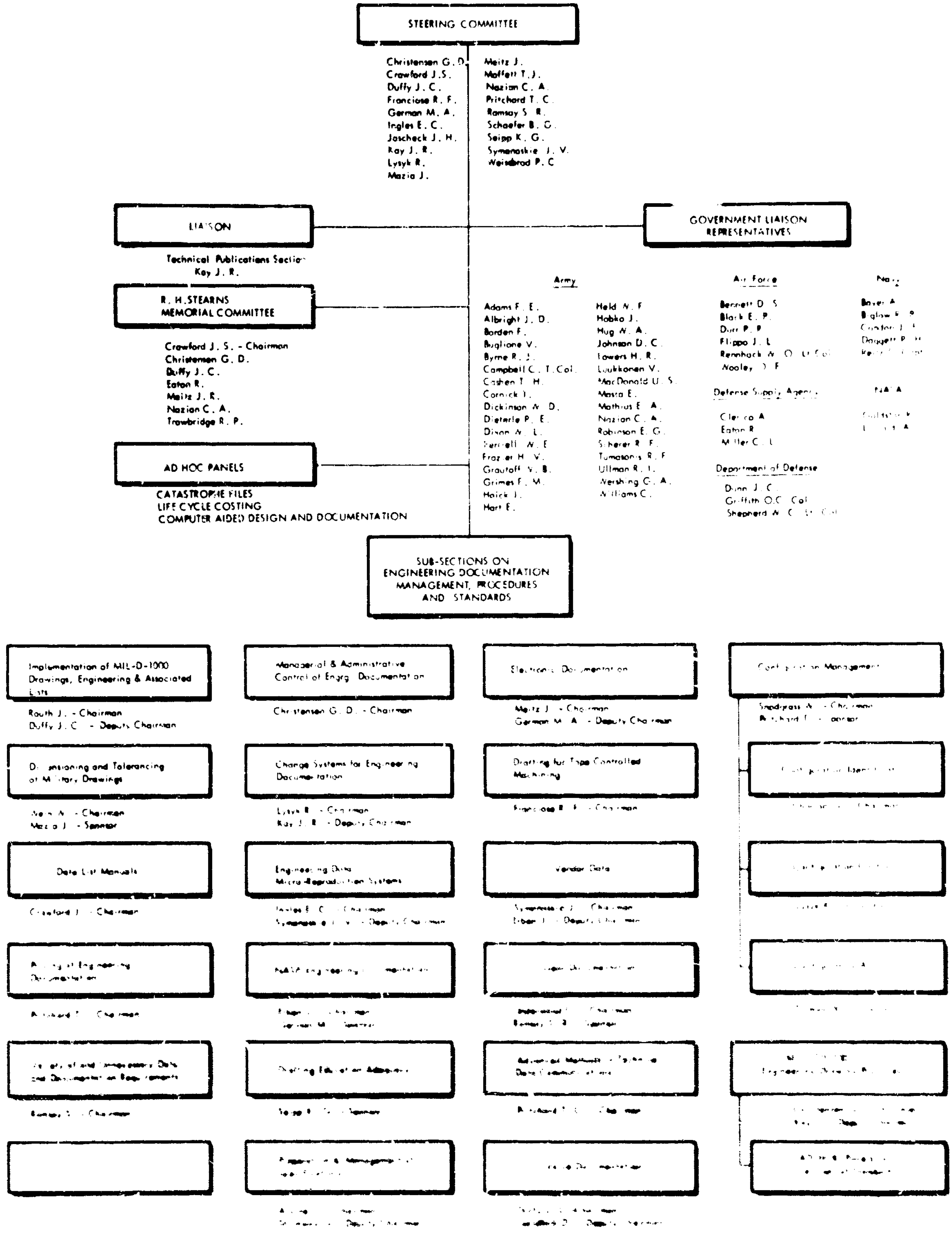
Meetings of the entire Documentation Section are held once each year. Meetings are well attended by both industry and military specialists in the field, so expressions of opinion on various points of view often give participants a first-hand insight into evolving policy or developing problems. Industry participants hear, first-hand from representatives of Government who are present, specification intent and interpretation that otherwise may be missed in the general day-to-day reading of specifications.

Interchange of information in the specialty field of documentation inevitable when military and industry people get together. Thus, the Engineering Documentation Section developes into a clearing house for professional information regarding military documentation.

SECTION PAGE

ORGANIZATION CHART - AMERICAN ORDNANCE ASSOCIATION
ENGINEERING DOCUMENTATION SECTION

Weisbrod P. C. - Chairman
Moffett T. J. - Deputy Chairman
Joscheck J. H. - Secretary
Seipp K. G. - Publicity Director



A. WEDNESDAY MORNING SESSION - APRIL 27, 1966

INTRODUCTION

This section contains the following papers and reports presented on Wednesday morning; Presiding Chairman, Phil C. Weissbrod; Recording Secretary, James R. Kay.

- Opening Remarks,
  by Phil C. Weissbrod

- Proclamation American Ordnance Association Days
  by Honorable J. Owen Eubank
  Mayor of Daytona Beach, Florida

- Opening Remarks,
  by William W. Thomas

- Opening Remarks,
  by Major General Edward P. Mechling, USAF (Ret.)

- Keynote Address,
  by Major General Allen T. Stanwix-Hay, USA

- The Office of Technical Data and Standardization Policy, Its Purpose and Its Program,
  by Colonel Ole C. Griffith, USAF

- The Many Faces of MIL-D-1000
  by Chester A. Nazian

- Engineering Data Management
  by Jack L. Flippo

- Air Force Implementation of MIL-D-1000
  by Paul R. Durr

P.C. WEISBROD
PRESIDING CHAIRMAN

J R. KAY
RECORDING SECRETARY

HON. J.O. EUBANK

MAJ. GEN. E.P. MECHLING
USAF (RET)

W.W. THOMAS

MAJ. GEN.
A.T. STANWIX-HAY
USA

LT. COL. O.C. GRIFFITH
USAF

C.A. NAZIAN

J.L. FLIPPO

P.R. DURR

OPENING REMARKS

Mr. P. C. (Phil) Weissbrod
Manager, Documentation Standards
General Electric Company

Mr. Weissbrod opened the meeting on time. After welcoming the attendees, he expressed the Section's appreciation and thanks for the efforts of the Program and Business Managers, Ralph Lysyk and Miles German. He also introduced the Steering Committee to the membership, and presented his annual message from the Section Chairman:

A Message From The Section Chairman

It has become a normal procedure for the section chairman to make an annual report relative to the accomplishments of the section during the previous year to the section members. Once again it is time for this report. Our accomplishments for this past year have been significant and our progress continues toward the realization of our goals and objectives.

At the May meeting of the Steering Committee, the subsection structure was reorganized. The following subsections were eliminated because they had completed their assigned tasks:

1. Modes of Documentation - Chairman, J. V. Symanoskie
2. Drawing Requirements for Springs, MIL-STD-29 - Chairman, J. V. Symanoskie
3. Item Identification - Chairman, H. K. Sedgwick
4. Implementation of MIL-STD-2 Drawing Sizes - Chairman, E. Nauth
5. Preparation of Lists by EAM/EDP Methods, MIL-STD-30 - Chairman, M. A. German.
6. Implementation of MIL-STD-7 and MIL-STD-280, Types and Definitions of Engineering Drawings - Chairman, J. H Jascheck
7. Change Systems for Engineering Documentation - Chairman, R. Lysyk

I wish to express my thanks to the chairmen and members who contributed to the excellent and effective work of these subsections.

The titles of the following subsections were changed to be more definitive of the work that was being accomplished:

1. "Implementation of MIL-D-70327, Drawings, Engineering and Associated Lists" to "Implementation of MIL-D-1000, Drawings, Engineering and Associated Lists" - Chairman, J. Rauth

2. "General Drafting and Dimensioning, MIL-STD's 1 and 8" to "Dimensioning and Tolerancing of Military Drawings" - Chairman, W. Wein - Sponsor, J. Mazia

3. "Microfilm and Aperture Cards" to "Microfilm and Associated EAM Cards" Chairman, E. C. Ingles

4. "Advanced Development in Documentation" to "Advanced Methods in Technical Data Communications" - Chairman, T. C. Pritchard

The following new subsections were established:

1. Quality Assurance of Engineering Documentation
   Chairman, J. Duffy
2. Pricing of Engineering Documentation
   Chairman, T. C. Pritchard
3. Vendor Data - Chairman, J. Symanoskie
4. Variety of and Unnecessary Data and Documentation Requirements
   Chairman, S. Ramsay
5. Configuration Management - Chairman, W. Snodgrass - Sponsor, T. C. Pritchard
6. Data List Manuals - Chairman, J. Crawford
7. MIL-STD-100, Engineering Drawing Practices
   Chairman, G. Christensen

Two symposiums on MIL-D-1000 and MIL-STD-100 were sponsored by our section and the National Security Industrial Association. One was held in Washington on June 14 and the other in Los Angeles on June 18. These symposiums were very well attended and it was a pleasure to be able to provide this type of service for the Department of Defense.

A publicity brochure has been issued by our publicity director and will be used to inform new members and interested Government personnel of the activities of our section.

The seventh annual meeting was held in May at Los Angeles and was an outstanding meeting. Over 350 attended and they participated in the very fine program.

We have continued the publication of the tri-monthly informative bulletin, and this has helped to keep our members informed of the latest development in Configuration Management, Data Management, and Engineering Documentation.

A special Ad-Hoc panel has been organized for the study of Life Cycle Costing and Equipment Procurement.

A DOD/AOA discussion group on Computer-Aided Design and Engineering Documentation was organized and held its first meeting. As a result of this meeting seven position papers are being developed and will be issued in the very near future.

Most all of our subsections have been very active during the past year and we look forward to continued and informative activity during the year ahead.

There have been other activities of minor importance which your Steering Committee has initiated to further the progress of our objectives and goals in the field of Engineering Documentation.

All in all it has been a good year. We now must look ahead in the future. Membership participation in the subsection activities is the only way that you are going to keep current and assist in the important work of the subsection.

We all know what the present is and the future offers much challenge. We are at the threshold of Computer-Aided Design and Man/Machine Graphics. Quality Assurance of Documentation is going to be emphasized. Data Management and Configuration Management are going to be stressed. It behooves us all to become as informed as possible in order that we may better perform in our assigned responsibilities.

AMERICAN ORDNANCE ASSOCIATION DAYS

Honorable J. Owen Eubank
Mayor
City of Daytona Beach,
Florida

The Honorable J. Owen Eubank, Mayor of Daytona Beach, Florida, welcomed the attendees to Daytona Beach, and presented a Proclamation establishing American Ordnance Association Days for this meeting.

Proclamation

The City of Daytona Beach
COMMISSION MANAGER PLAN
DAYTONA BEACH, FLORIDA

AMERICAN ORDNANCE ASSOCIATION DAYS

WHEREAS, One of the most important parts of our National Defense is the Engineering Documentation Section, Technical Documentation Division of the American Ordnance Association which is composed of representatives and specialists of industry and governments who meet to study the advancement of technology, production and logistics in connection with ordnance, armament weapons, weapons systems and related equipment; and

WHEREAS, The City of Daytona Beach is honored to welcome the distinguished members of the American Ordnance Association to our city for their Eighth Annual Meeting April 27 thru 29, 1966.

NOW THEREFORE, I, J. Owen Eubank as Mayor of The City of Daytona Beach, Florida do hereby proclaim April 27 thru April 29, 1966 as **AMERICAN ORDNANCE ASSOCIATION DAYS** in The City of Daytona Beach, Florida in appreciation to those representatives and specialists of industry and government who give so freely of their valuable time to solve and eliminate problems in connection with complexity, costliness, technical knowledge, standards, specifications etc. that go into Engineering documentation to provide the very finest ordnance, armament weapons, weapons systems and related equipment for our armed forces and our Country's vital defense to preserve our way of life in peace and war.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of The City of Daytona Beach, Florida to be affixed this 25th day of April 1966.

J. Owen Eubank
J. OWEN EUBANK
Mayor

Mayor Eubank presented gold keys to the city to P. C. Weissbrod and Ralph Lysyk.

OPENING REMARKS

Mr. W. W. Thomas
Radio Corporation of America
Chairman, Technical Documentation Division
American Ordnance Association

Data, and particularly engineering drawings are means to an end, not the end in itself. Likewise, the specialist in drawings must provide subservient support to those who accomplish their objective through drawings. At the same time drawing systems must be flexible so that they do not reshape the basic objectives for which they are being used.

At this meeting we are on a threshold. The technical elements of our specialty tempt us to cultism. The efficiencies available to us if we standardize attract us to greater details of regulation

We must be sure we do not go too far overboard in both these areas. Only as individuals can we maintain the fine balance needed. I ask you each to recognize these influences as you contribute to the decisions which will be made in the next few days.

OPENING REMARKS

Major General Edward P. Mechling, USAF (Ret.)
Director of Advisory Service
American Ordnance Association

It is a great privilege this morning to open my remarks with a tribute to the AOA's Engineering Documentation Section for its eight years of highly successful operations. To Bill Thomas, Phil Weissbrod, the Steering Committee, which retains most of the original members, and to the Sub-Section chairmen, go out deep appreciation for their continuing and successful efforts.

From its inception, the basic concern of this Section has been with efficiency in Documentation and effective Cost Reduction, through buying only what is needed; by establishing common documentation specifications and standards for all Defense Agencies and utilization of modern methods.

The initial objective of securing as members for this Section, the drafting engineers of all companies active in defense business, has been achieved. The continuing study of identifiable problem areas by Sub-Sections under the control of the Steering Committee, has enabled the Section to initiate timely recommendations for improvement to Government Agencies for comment and advice.

This Section has been most successful in securing full representation and active participation by DoD, all the Services and NASA.

Their outstanding Annual Meetings, during which important current problems are discussed in depth, with high professional competence, has been an example to all operations of our Association.

You are aware that we have made some changes in our AOA operations. In making these changes, you will recognize that the successful experiences of this Section has been fully applied to the new organization.

The Directive of the Board of Directors to expand our Technical Operations into the AOA Technology and Management Advisory Service, has essentially been completed.

On March 8, 1966, Bulletin #1 was published, which announced the organization of the new Advisory Service. It outlines the general objectives, operations, and organization.

The organization is headed by the Vice-President for Advisory Service. Assisting him are the General Chairmen for the Department of Defense, Army, Navy and Air Force. In addition to myself as Advisory Service Director, Headquarters staff consists of three Assistant Directors:

<u>Col. John R. V. Dickson, USAF (Ret.)</u>
Assistant Advisory Service Director for the
Defense Management Divisions.

Cdr. Arthur D. Sullivan, USN (Ret.)
Assistant Advisory Service Director for the Technical Support Divisions.

Col. Gilbert P. Dubia, USA (Ret.)
Assistant Advisory Service Director for the Weapons Technology Divisions.

We have designated what was our highly successful Executive Technical Board as the Advisory Service Board, with the same general duties and membership. The work of this Board in developing major areas for our operations, in coordinating the activities of our Divisions, and motivating our whole operation to a high level of effectiveness, has been impressive.

We have five Standing Committees, which work with our Advisory Service Board and with Headquarters. They are the three Service Liaison Committees - Army, Navy and Air Force - and a new Industry Liaison Committee. This Committee under the chairmanship of Mr. Jesse M. Hadley, Bendix Corporation, Washington, D. C., will include the former members of the Washington Liaison Committee of the Missiles and Astronautics Division. These members are in most part, past Presidents of the Washington Chapter.

We are in the process of organizing a Standing Committee on "Needs Analysis." This committee will be concerned with the processes by which military requirements are developed and hopefully will be able to obtain analyses and requirements information that will be useful to our Divisions.

Our Defense Management Divisions' category is new. We now have four of the Divisions in operation. They are:

1) Technical Documentation Division -
Which has been most effective for several years.

2) Mobilization Readiness Division -
Under the leadership of Mr. William E. Haines, Vice President of the H. K. Porter Co., Inc., Washington, D. C., has completed its organization and is organizing its first full Division Meeting in collaboration with the Industrial College of the Armed Forces at Fort McNair, Washington, D. C., on October 12-13, 1966.

3) The Quality and Reliability Division -
Mr. E. Howard Halpin, General Electric, Burlington, Vermont, Chairman - has been organized since February 1965.

4) Value Engineering Division -
This Division will be organized from the Special Committee at a meeting on June 8, 1966.

We have had one planning session on the Management Division. The next planning and organizational meeting will be devoted to completing the Division organization. We expect to provide a flow of information to our company members which will be useful for corporate planning for participation in the Defense effort.

A new Manual will be issued by the end of this summer which will be known as the "Advisory Service Manual." The introduction to the Manual, the revised Mission Statement, and the Organization Chart for our AOA Advisory Services are attached.

INTRODUCTION
ADVISORY SERVICE OPERATIONS MANUAL

Our Technology and Management Advisory Service is an organized and integrated effort that provides support to Government Defense Agencies and to the industry members of the Association. The successful experience acquired during 17 years of A.O.A. technical operations has been combined with an analysis of future trends in establishing our advisory service.

Our basic purpose is to perform a truly useful and important service for our industry members as well as for Defense Agencies of Government. We are continuing with increased emphasis, all of our successful and active operations. We are adding new organizations and capabilities in the field of Defense Management.

We have eliminated all artificial limitations to our scope of operations. In considering new areas we ask ourselves -- Is it useful? Is it important? Is it legal?

The major changes being made by the Association in establishing this augmented service are:

a. To broaden the statement of our General Objectives.

b. To augment the Headquarters Staff.

c. To change the name from Technical Operations to Technology and Management Advisory Service.

d. To expand our organization to include three (3) categories of Divisions:
   (1) Defense Management Divisions
   (2) Technical Support Divisions
   (3) Weapons Technology Divisions

e. To revise operating procedures in line with new objectives, scope and organization.

The detailed objectives of our Divisions and Sections are set forth in the Section of this Manual on Division Categories and Scope.

In addition, we emphasize the following basic objectives:

1. To provide useful service to our company members and to Defense Agencies of Government.

2. To organize and maintain the capability to operate effectively in the important areas of Technology and Management that are of current concern.

3. To serve as an effective channel for the Defense Agencies of Government to use in presenting information and problems to "Industry."

4. To prepare and present to the Government, the Association's recommendations for increasing the effectiveness of the Defense effort and the effectiveness of Industry's part in the Defense Effort.

5. To respond with our best capability to Government requests for advice, studies, reports and for the conduct of Government-Industry Meetings, large and small.
6. To maintain effective relationships and liaison with Government Defense Agencies.
7. To secure cooperation and participation of pertinent Government Agencies in our meetings and other operations.
8. To guard our privilege of classified meets by rigorous adherence to Security Directives.

MISSION STATEMENT OF THE ASSOCIATION

This Association exists for the advancement of adequate National Defense in the fields of Management, Mobilization Readiness, Technology Production and Logistics. We strive to improve the effectiveness and efficiency of the Government-Science-Industry relationship in these fields.

Our categories of operation are Management, Technical Support and Weapons Technology. Our technical emphasis is on Weapons Systems, Armament, Munitions and related equipment. Our Technical Support covers Materials, Processes and Techniques of wide application. Our Management interest includes broad contractual relations of current general concern and Mobilization Readiness.

Through its publications and meetings, the Association endeavors to educate its members and the public on National Defense and Industry's part in the Defense Effort.

Our Technology and Management Advisory Service brings Industry's "Know How" to Government Agencies.

This nonprofit - Nonpolitical organization founded in 1919, being fully aware of legal restraints will not permit in any of its operations any discussion or concern with placement of specific contracts, specific pricing, or specific allocation of materials. The Association will cooperate to every practical extent with other recognized federal and industrial Associations in assisting the Defense Effort.

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NOTE: The above Mission Statement will be read at all Advisory Service Meetings.

ORGANIZATION
TECHNOLOGY AND MANAGEMENT ADVISORY SERVICE

Vice Pres. for Advisory Service

General Chairman - Department of Defense
General Chairman - Army
General Chairman - Navy
General Chairman - Air Force

Advisory Service Director
Administrative Staff

Executive Board Advisory Service

Association Officers
Division Chairmen
Dir. & Ass't Dir.
Additional Members

Standing Committees

Needs Analysis
Army Liaison
Navy Liaison
Air Force Liaison
Industry Liaison

DEFENSE MANAGEMENT DIVISIONS
Ass't Advisory Service Director

1. Documentation
2. Management
3. Mobilization Readiness
4. Quality and Reliability
5. Value Engineering

TECHNICAL SUPPORT DIVISIONS
Ass't Advisory Service Director

1. Critical Components
2. Electronics
3. Maintenance
4. Materials
5. Packaging
6. Production Equipment and Techniques
7. Research
8. Standards and Metrology

WEAPONS TECHNOLOGY DIVISIONS
Ass't Advisory Service Director

1. Air Armament
2. Ammunition
3. Artillery
4. Chemical, Biological and Nuclear
5. Combat and Tactical Vehicle
6. Fire Control
7. Missiles and Astronautics
8. Small Arms and Small Arms Ammunition
9. Underwater Ordnance

KEYNOTE ADDRESS

Major General Allen T. Stanwix-Hay, USA
Director, Office of Technical Data and Standardization Policy
Office of the Assistant Secretary of Defense (I&L)

(Presented by Colonel Ole C. Griffith, USAF)

I must admit to you that the preparation of a keynote speech is a difficult task. According to my Webster New World Dictionary, a keynote address is the "Basic idea or expression of the basic policy." The same volume states that a meeting is "an assembly, a gathering of people to discuss and decide. A point of contact or intersection. A junction. A hostile encounter."

Truthfully, I thought long and frustratingly over my position as your keynoter. I recognized at once that I am not your Section Leader and my ideas might well be at variance from his. I called for your agenda to guide the efforts to design an envelope for this meeting, whether that be to discuss and decide, contact, intersect, or combat. I called your Chairman to see whether he wanted some of his gems of wisdom incorporated in the keynote.

Therefore let the keynote slogan for this meeting be AVANT REGARDEZ, "Look Ahead." And let the keynote platform be the following:

1. The requirements for data must be explicit.

2. The data delivered must be adequate for its purpose.

3. The payment made for data be for value received.

4. The use of the data be for the greatest good.

5. Tomorrow's problems be looked at today.

Within that platform, lies the work of your Office and my Office. It is not your task to consider that platform only as it applies to one of your customers, but to all of your customers. What is basically good for the smallest, should be advantageous to the largest. What lies ahead that you must be prepared to discuss and decide, to come to grips with, to combat?

(1) To the very largest and to the very smallest of American industry and American industrial purchasers, I believe the time has come to look forthrightly at tape controlled machines and conventional data. Are we going to make proposals through our Associations to our customers, or are we going to sit back and wait for our customers to ask questions? As the definition of a "meeting" says, do we discuss or do we also decide? Should we not be giving serious thought to the management of tapes as data in place of drawings? There are certain offices that I feel sure would relish the opportunity to enter into discussion that could lead to policy decisions. I hope these people will get together, and I suggest this Section of AOA is the place to spark such studies.

(2) Some weeks ago, interested members of this Section and some friends came together to discuss computer aided design. I need not go into the details of that meeting, but what is this Section going to do about that and follow-on meetings? Whether you want to face it or not, you as engineer-managers are facing one of the great challenges of your time. Has your <u>working industry</u> been touched by automation? To use another's words, "Why not engineering, the effort of designing and documentation. Much of the effort is repetitive, much is tedious, much is ill organized. The technology is here now." To my thinking, the only deterrent to flank implementation is imagination and moneys to be expended. I do not doubt American imagination, and when competitors begin to advance with imaginative management leading to <u>profits</u>, the funds will be automatic! Is this a valid reason for this meeting? To again use the words of my teacher, what will be the effect on engineering documentation that is in the form of a mathematical graphical model instead of a pencil applied to paper? How are drawing submittals to customers to be accomplished? Will we in Industry and we in Defense be ready, or shall we be overcome? I have a phobia about being overcome! Now it matters little to me whether computer aided design <u>takes</u> over, or becomes an <u>addition</u> to our present way of life. Under either condition the possibility of profitable automation of engineering design potential is <u>visible</u> and will necessitate an avant-garde approach. To stand still in this business is to die.

(3) What is the impact of dynamic advances in industry upon us? When a breakthrough like microelectronics descends upon us, do we come together for common answers, or do we tend to run to our private little cover called "fast profits?" Do we discuss and decide, or do we grub and hide? What is the best for us, when the us is all of us? Do we have opinions about specifications, documentation, criteria, standards for things like microelectronics? Would you come forward without payment and advise your government? What does one do about part numbering of integrated circuit devices; about drawings of devices so small; does one support such items; what documentation describes them scientifically, practically, and for procurement? How do we come together to solve the impact of dynamic industrial developments? Can we afford to wait-out each other?

(4) There is existent throughout the United States today a considerable quantity of talk about the English Inch versus the international metric systems of weights and measures. I had occasion not too long ago to have a man ask me pointedly, "What would be the impact upon me if conversion was ordered?" As I am habitually doing I went to my friends and sought counsel. I went also to friends overseas. As your keynoter, please let me say I was amazed at my initial findings; amazed at the clarity and thoroughness of some of the replies; and amazed that some had given little if any thought to such a conversion. Should not this Section recognize that such a problem is a part of our industrial environment? Should we not be prepared to speak knowledgeably if asked, or to advise knowledgeably if not asked?

(5) One of the two real innovations of data management by the Defense Department has been the principle of Deferred Ordering of Data. While much is being said on one side of the table, very little is being said

like "I don't like it." Either this technique is the best thing for industry since Henry Ford or there's not too much known about it! Its impact will be felt as implementation expands, and I suggest we learn the pitfalls as well as the advantages. Your meeting today will give you a chance to practice the art of searching questions if you desire.

(6) The other innovation to which I referred goes by the name of "Total Package Procurement." As this concept is seen at this point, it offers great potential. It also poses a big challenge. The conditions requisite for its use must be defined. I'm sure that your companies know all the answers to the <u>contractual side</u> of Total Package Procurement, as perhaps everyone here knows all the facets of the <u>documentation problem</u> for Total Package Procurement. Is Defense asking for too much data in total package competition, or are the competitors furnishing too much? Or both? Is this type of competition too expensive at both the prime and subcontract level? In view of the stakes, how much is too much, when often is included potential commercial sales. And lastly, how far should Defense go in applying this technique?

(7) It is your Keynoter's opinion that the value and price of documents must be recognized as a matter of priority. We have spoken of the data requirement being explicit. Can this ever be so if the value to both parties is unknown? There is no requirement for material things (that I know of) that fails to recognize <u>value</u> and worth as discriminating facts. Further, since we are dealing with contracts, the payment made for data must be known and be acceptable if all parties are to agree to value received. I suggest then that "meetings" (in all its definitions) must and should continue.

(8) There are many happenings in our Country today over which much talk and some demonstrations are taking place. These are national matters in which all of us have a strong personal interest. They become emotional to a degree. There are discussions taking place today in our field of documentation to which attentiveness should be directed. Should not we be interested in all elements of Data Rights? This is on your Agenda for Past, Present, and Future. Your Keynoter will be interested in "The Future" for I'd like to know just what I'm planning to do!

(9) Quality Assurance of documentation has now been elevated to a par with Data Rights, and Value, and should be a focal point for interest to those of us in this work.

With those thoughts as a vehicle I hope this body is prepared to do more than <u>hear</u> the speeches that will be given for the next few days. There is possibly already the germs of contentment or malcontentment with what I have said. There will possibly be much more of same by the end of the meeting. The results that matter <u>from this meeting</u> will be those statements upon which you take a stand. You will hear many things. There are many things being done. If this meeting does nothing but hear words, there will be no impact on things being done by this meeting. These Association Meetings can be heard and felt if the printed record of the meeting is not just distributed but acted upon.

I suggest your Section take a stand in controversy and let your feelings be known. Whether then you win or lose, you'll be a part of the impact and this meeting will be a success. There are offices today looking for the advice you have to offer. Take a stand and let your collective weight be felt.

THE OFFICE OF TECHNICAL DATA AND STANDARDIZATION POLICY: IT'S PURPOSE AND IT'S PROGRAM

Colonel O. C. Griffith, USAF
Acting Director
Office of Technical Data & Standardization Policy
Office of Assistant Secretary of Defense (I&L)

Last year in Santa Monica I presented to this Section a status report on the first year's operation of the Office of Technical Data and Standardization Policy. At that time, I spoke of our organizational structure. We looked at the Technical Data and Standardization Policy Council as the senior policy-making body of the Defense Department in this area of activity. We discussed the Technical Data and Standardization Policy Committee as the vehicle for obtaining inter-departmental viewpoints and recommendations. I talked about our own office and described the way in which it was organized along Service lines to facilitate our entre to the Military Departments and to the Defense Supply Agency during the formation period of our program. I also presented, for your information, the 38 projects which constituted the Director's Fiscal Year 1965 program.

Today I will update the status of the program, as I have done periodically for your steering committee, and review the highlights of our second year's activity.

As originally planned, we have re-aligned our office functionally. One Division, under Air Force Lt. Colonel Bill Shepherd, handles the matters associated with Technical Data Management and the acquisition of data from contractors, as well as engineering drawing management. The other, under Captain Bob Millar, USN, deals with the management of specifications and standards, technical manuals, and standardization policy in general. My Deputy is Army Colonel Jack Elder.

One thing has bothered General Stanwix-Hay and me ever since we came together two years ago. What is the relationship between technical data and standardization - policy for both of which is the responsibility of our office. It has seldom been possible to say "this is strictly a standardization problem" or "obviously, this matter is technical data".

We had long felt a desperate need for a rationale, - for a frame of reference - to which we could cling to keep from being engulfed in one of the many whirlpools sometimes known as management systems or management disciplines.

Some rationale is especially necessary to communicate with those who are not data experts. In the absence of an official rationale, each of us is at liberty to develop his own. To keep these concepts merely mental means that people in similar positions have difficulty communicating. I can tell you from experience, however, that the mental concept is not as vulnerable as the one reduced to writing. But our shop has always invited challenge and discussion. So this is our rationale; perhaps it can generate discussion leading to a more mature concept acceptable to others as a basis for a more uniform understanding, especially between the data people and the rest of the world.

To start with, consider data, - and I'll have to limit this to technical data. Rather than attempting to define the term, permit me just to place a ball-park fence around it. I'm referring here to engineering drawings and associated lists; specifications of all kinds, including MIL-SPECS and contractor-prepared documents; standards; technical manuals, and technical reports of all kinds. Usually, these data are usefully considered in two categories: Primary or source data and supporting data. Source data is that which gives engineering definition to parts, equipment, assemblies, materials, processes, etc. Supporting data are derived from source data and include technical manuals, reliability statistics, and configuration management information.

Technical data is, or should be, acquired only because a need exists. Let's establish who has the need. Fundamentally, the need exists in the hard-core functional organizations of the Department of Defense, such as Research and Development, Engineering, Procurement, Supply, Maintenance, Operations. I suppose some will take exception that I do not include standardization, or reliability as a hard-core function, but I will treat them later. The hard-core functions carry out the traditional basic mission of design, purchase, manufacturing, testing, using, supply, maintenance, and disposal. In the mission of each, technical data plays a major role. Each function, each user until recently, called his own shots on the quantity, quality, format, delivery, and use of the data which he needed, or thought he needed. There was little or no coordination, and even less detailed analysis, and no mechanism for scrubbing down requirements.

In my rationale, technical data is only a tool, albeit a <u>separate</u> tool with form, format, and cost. Yet it is only a tool and has no value of <u>itself</u>. As with a bullet, it is of value only when used, or possessed as a threat for use. Its value is proportional to the use made of it, and for my part, its use is in proportion to its quality or utility. There are two interesting and common characteristics of data. It is a perishable commodity, and it is a costly commodity.

Because of its high cost and perishable nature, technical data is a resource which must be managed, just as dollars and manpower need to be managed.

It was into this arena of material, of competing functions, of individualism, of unknown costs, of no management, of no rationale, that the Defense Department opened its thinking on technical data.

Part of the job has to do with the making and implementing of policies. Policies are needed in four areas:-

1. Organization for management of data.
2. Creation and acquisition of data.
3. Handling, storage, and retrieval of data.
4. Use or application of data.

Some of these come to light as acts of management, and some are unloaded upon the unsuspecting by a gracious Congress. Some originate from the suggestions and criticism of Industry. - From wherever they come, there must be policy studies, written, and implemented.

And so from necessity, from knowledge, from Congress, from Industry, there has come a dicipline of technical data management in response. These developments come from internal and external influences, and even some constraining factors have to be considered. These influences and constraints are such things as

Time
Dollars
People
Political considerations (competition)
State-of-the-Art
User Demands
Equipment complexity.

Within this same arena have come other management disciplines, and they too respond to certain influences and constraints. These parallel disciplines also modify the way in which the hard-core functional organizations perform their missions. Some of them, well known to you, are -

Configuration management
Program definition
Value Engineering
Quality Assurance
Reliability assurance
Standardization
PERT.

Some of these have indeed been around for a long time, some have changed in response to changing influences, and some may in time be supplanted. As is true of the hard-core functional organizations, the management disciplines depend heavily on technical data. Frequently, of course, they also create their own peculiar data of the supporting type. They generate tremendous requirements for data.

Why have we bothered to develop this rationale? To work with data is to work with mercury. If it is shocked, it will separate and proliferate. If guided, prodded, it has an affinity to central control. A framework, a rationale permits the sorting of the work into logical parts. One must have a concept to identify the relationships of the mercuric parts. This is my concept.

Secondly, it identifies technical data as a "common language" to facilitate communication among and between the various <u>functional managers</u>.

Thirdly, it provides a basis for studying the relationships among and between the various management <u>disciplines</u>. There is a tie here to general management that can, if properly adapted, solidify the entire organization.

Now please don't conclude from what I have said that I imply that all but me and thee are cultists. There is a very real danger that those of us who are concerned with data management may also become cultists! Vital as it is, data performs primarily a supporting role. Without the overall mission consideration, - data and our concern with its management are useless. The mission must be paramount.

It is in this framework, in this rationale, that we see our work. It is a resource, it costs tremendous sums, it must be managed within functions, for it is <u>not</u> an end to itself.

Against the background of this rationale, I would like to review with you our FY 1966 program. The list covers 62 projects, including those that have been completed. It is a flexible and dynamic program - one that must be capable of adjusting to changing priorities and influences. The Southeast Asia situation has affected our program as it has many others. I must consider not only the availability of the resources of my own offices, but the workload impact of our projects upon the Military Departments and upon our good friends in Industry who have given so generously of their time and talents in working with the Department of Defense to develop a viable body of policies and procedures.

Project No. 5. ESTABLISH TRAINING PROGRAM FOR DATA MANAGERS.

This is a completed project. A 4-week course for twenty-five students per class was initiated at Wright-Patterson Air Force Base in August of 1965. Five classes have been completed. Our FY 67 schedule is also for five classes. We had hoped to increase the number of classes for next year but have had to cut back slightly in view of manpower availability. Our original plan was to train 1100 Department of Defense Data Management personnel in the initial five-year period. If we continue present training schedules, this would result in a total of 600. In response to many Industry requests, arrangements have been made for one Industry student in each class beginning in September. The student will be selected by the Technical Data and Standardization Policy Committee.

Project No. 16. REVISE 70327.

As reported last year, this project was completed with the publication of MIL-D-1000. Related actions such as the revision of MIL-STD-100 are carried under other projects. We have no present plans for early revision of MIL-D-1000 except to add additional notes for explaining the "Intended Use" concept.

Project No. 18. MONITOR PILOT TEST OF ENGINEERING DATA RETRIEVAL SYSTEM.

The role of our office in this project was to monitor the pilot test of the engineering data retrieval system which was conducted by an Army-Navy-Air Force-Defense Supply Agency team under the administration of DSA. The results of the pilot test, along with the teams' recommendations, have been presented to the Technical Data and Standardization Policy Council. The complete report has been sent to all DoD components for comment. The report itself, as well as the various comments will be evaluated by Mr. Walter Carlson, the Director of Technical Information. Under DoD Instruction 5010.13, Mr. Carlson is the functional manager for data systems. He will at the same time be considering other systems such as the Air Force's ELI (Engineering, Logistics Information System). The final decision on EDRS will be made by the Technical Data and Standardization Policy Council.

Project No. 28. ASCERTAIN REQUIREMENT FOR VARYING STANDARDS OF QUALITY ASSURANCE AND ACCEPTANCE PROCEDURES FOR TECHNICAL DATA (EXCLUDE TECHNICAL MANUALS)

A subcommittee of the Technical Data and Standardization Policy Committee has been charged with developing policies and procedures for the improvement of the quality of all technical data other than manuals. It has become apparent that the major data quality problems have to do with engineering drawings. For this reason, the data subcommittee will be combined with the drawing practices subcommittee which is Chaired by Mr. Donald Mitchell of my office. At present the subcommittee is conducting a DoD-wide survey of current quality assurance practices.

Project No. 32. COST OF TECHNICAL DATA EFFORT WITHIN DoD.

A significant milestone in this project was reached in late 1965 with the publication of Enclosure 5 on DoD Instruction 5010.12. This document provides for the contractor to estimate the price of each data item on the Form 1423. Appropriate ASPR provisions are being developed to provide uniform application policy. Our office is also developing a reporting system to provide for summary information on data prices for management use at various levels. The corollary effort will provide for reporting costs of inhouse preparation of technical data as well as for data storage, handling and retrieval. The final element of total technical data cost that we have identified is that of contractually required "non-deliverable" data. The development of a reporting system for this class of data has been deferred in favor of more urgent projects.

Project No. 39. NSIA TECHNICAL SYMPOSIUM.

This symposium was held last May in Los Angeles. It was attended by approximately 400 top management officials of Industry and the Department of Defense. About six months after the symposium, General Stanwix-Hay sent a follow-up letter to each of the invitees to ascertain the effect of the symposium. 70% of the replies indicated that the symposium had been beneficial in all respects. 15% were critical of some aspect of the meeting, while 15% had no comments. Analysis of the replies indicate that 20% favored additional future symposia and confirmed that the symposium had provided the impetus for improved data management in their firms. In this follow-up letter the attendees were invited to make specific suggestions for improving DoD data management. The most frequently made suggestion was that the technique of deferred ordering of technical data be expanded. About one-third expressed concern over our policies on Rights in Data and/or Data Pricing.

Project No. 44. DEVELOP FIVE-YEAR PROGRAM FOR SPECIFICATIONS AND STANDARDS.

This is the top priority project of our office in the standardization area. All Department of Defense components are required to submit to us by June 1, 1966 their five-year program, in annual increments, of specifications and standards preparation or revision. Planned completion dates and project priorities are to be shown. This will provide the basis for program and resource control and will be tied-in with the Five-Year Force Structure and Financial Plan. Other desirable projects have had to give way in favor of this one.

Project No. 52. REVIEW THE PROBLEM OF THE QUALIFIED PRODUCTS LIST.

This project resulted from our decision to study some 2,000 specifications, covering a wide range of commodities which require qualification testing and the establishment of Qualified Products Lists. We were concerned as to the thoroughness with which ASPR criteria were being applied. A DoD-wide survey of these specifications was conducted to reveal:

The extent of coverage required.

The validity of current criteria.

Necessary changes to more effectively operate the Qualified Products List process.

Analysis of the survey results, together with Industry comments, lead us to these conclusions:

1. Qualification is justifiable requirement under certain conditions.
2. Qualified Products Lists must be kept more current.

3. There is a need to enforce requalification requirements and justification reviews.

4. The significance of qualification and the importance of production quality assurance requirements need to be emphasized to dispel the misconception that qualification provides any assurance of continued quality.

5. Finally, the number of Qualified Products Lists should be reduced by eliminating qualification requirements for non-critical items.

It appears at this time that about one-third of the specifications surveyed are likely candidates for revision, cancellation or deletion of qualification requirements. Appropriate actions, based on the analysis of the survey, are now underway. Copies of this report, which was prepared by Mr. Lester Fox of our office, have been distributed to AOA and other organizations which provided recommendations to us.

Project No. 58. ESTABLISHMENT OF THE OSD AUTHORIZED DATA LIST.

Until recently the development of a DoD Authorized Data List has been a very high priority project and had been assigned to a subcommittee of the Technical Data and Standardization Policy Committee. The development of such a list has been an almost universal recommendation of Industry. However, the manpower implications of this project are extremely large. For this reason, the scope of the project has been reduced to a feasibility study and the development of a general model for a DoD ADL.

Project No. 59. EVALUATE COMPUTER AIDED DESIGN AND DOCUMENTATION.

This project is an outgrowth of last year's annual meeting of the Section in Santa Monica. At that meeting an excellent seminar on computer-aided design was held. The moderator, Mr. Thurber Moffett, indicated in his summary that it would be very desirable for Industry and the Department of Defense to meet and identify those DoD policies which might have the effect of preventing the realization of the full potential of this technology. As a result of this challenge, General Stanwix-Hay asked General Mechling if AOA would be willing to bring together an appropriate group of people from Industry and the academic world to meet with Department of Defense representatives. As a result, a very fruitful meeting was held in Washington last Fall. Based on this meeting, a series of position papers was developed and published in an outstanding AOA technical report which has recently been delivered to us. A study of this report by our office and by the other DoD components leads us to these two tentative conclusions.

1. We accept the position discussed in Mr. Pritchard's paper that the DoD must be forgiving on the style and format of the technical communication resulting from computer utilization.

2. Standardization will be necessary, particular in view of the report's conclusion that eventually DoD must have a computer graphic capability. The problem is when to standardize and in what areas. Certainly premature standardization is to be avoided.

These two conclusions indicate that an early follow-up meeting between DoD and Industry is necessary.

Gentlemen, my allotted time is about up. I will summarize very briefly. Since my last report to you, our emphasis in the area of standardization has progressed from major policy overhaul to policy implementation and programming.

With respect to technical data our emphasis is shifting from program and policy development to assuring implementation - particularly with respect to contractor data acquisition.

As General Stan suggested, "Let your Section take a stand in controversy and let your feelings be known".

There are some provocative titles on your agenda. Don Spencer has permitted me a peek at the paper he will present tomorrow. He will take a few pokes at some sacred cows. I say "Fine". I'm sure that all of my DoD colleagues in this room share my desire to explore such ideas further to learn how widely they are held, and to respond accordingly. To quote a friend (and he is a friend partly because he is a critic),- "-------few of us will be doing five years hence, all those things we do, or contemplate doing today. We are in an evolutionary phase-----."

DIRECTOR'S PROGRAM

1. ESTABLISH A DOD TECHNICAL DATA AND INFORMATION SYSTEM FOR IDENTIFICATION, COLLECTION, SCREENING, STORAGE, RETRIEVAL, AND DISTRIBUTION.
2. ESTABLISH DOD STANDARDIZATION POLICY. COMPLETED
3. INVENTORY AND INVESTIGATE CURRENT MAJOR EFFORTS OF DEPARTMENTS IN THE TECHNICAL DATA AREA OF INTEREST.
4. ORGANIZATION FOR IMPLEMENTING DOD POLICY ON STANDARDIZATION THROUGHOUT THE DEPARTMENT OF DEFENSE. COMPLETED
5. ESTABLISH TRAINING PROGRAM FOR DATA MANAGERS. COMPLETED
6. EXPAND PARTICIPATION IN DOD TECHNICAL DATA AND STANDARDIZATION PROGRAMS BY OSD FUNCTIONAL MANAGERS.
7. ESTABLISH WORKING GROUP BETWEEN ODDR & E & OASD (I&L) IN OUR FIELD OF RESPONSIBILITY. COMPLETED
8. INVESTIGATE INTRA-SYSTEM STANDARDIZATION. COMPLETED
9. ASSESS ACQUISITION CRITERIA FOR TECHNICAL DATA. COMPLETED.
10. IMPLEMENT COST REDUCTION PROGRAM THROUGHOUT THE ENTIRE TECHNICAL DATA AND STANDARDIZATION AREA. COMPLETED
11. ACCELERATED ACTION TO IMPLEMENT DIAC RECOMMENDATIONS. COMPLETED
12. BRING STANDARDIZATION PROJECTS UNDER PROGRAM CONTROL OF TECHNICAL DATA & STANDARDIZATION POLICY COMMITTEE.

13. ASSIST IN DEVELOPMENT OF SEPARATE CAREER FIELD STANDARDS FOR DOD TECHNICAL DATA MANAGERS.

14. ACCELERATED ACTION TO IMPLEMENT ABERDEEN RECOMMENDATIONS.

15. REVIEW SPECIFICATION CENTER AT PHILADELPHIA. EXPAND INPUT AND USE. COMPLETED

16. REVISE 70327. COMPLETED

17. ELIMINATE OVER-AGE SPECIFICATIONS.

18. MONITOR PILOT TEST OF ENGINEERING DATA RETRIEVAL SYSTEM.

19. TECHNICAL MANUAL REVIEW.

20. REVIEW PROCEDURES FOR TRANSFER OF DEVELOPMENT DATA TO MEET LOGISTIC NEEDS.

21. ASCERTAIN THE VALIDITY OF DATA RETRIEVAL USE BY ENGINEERS. WILL ENGINEERS USE RETRIEVAL SYSTEMS FOR ENGINEERING DATA?

22. ASCERTAIN USE OF RETRIEVAL BY GOVERNMENT ENGINEERS. IS DESIGN DONE IN-HOUSE? STUDY OWNERSHIP OF RETRIEVAL SYSTEMS.

23. STUDY TIME CYCLE FOR SPECIFICATION PUBLICATION WITH VIEW OF TIME REDUCTION. COMPLETED

24. DEVELOP CATALOGING OF ENGINEERING DRAWINGS. INVESTIGATE METHODS OF DISPLAY. AVAILABILITY FOR USE.

25. SIMPLIFICATION OF SPECIFICATION FORMAT (REVISE SECTION V).

26. INVESTIGATE DECENTRALIZATION OF SPECIFICATIONS TO OTHER LOCALES.

27. CONFIGURATION MANAGEMENT AND ITS AFFECT ON DATA IN PROCUREMENT, MAINTENANCE AND SUPPLY.

28. ASCERTAIN REQUIREMENT FOR VARYING STANDARDS OF QUALITY ASSURANCE AND ACCEPTANCE PROCEDURES FOR TECHNICAL DATA (EXCLUDE TECHNICAL MANUALS).

29. INDEX OF STANDARDIZATION PROJECTS. COMPLETED

30. MANAGEMENT METHODS FOR CONTROL OF DATA (NAVY'S DATA REVIEW BOARDS). COMPLETED

31. STUDY OF DATA ACQUISITION FROM SUBCONTRACTORS.

32. COST OF TECHNICAL DATA EFFORT WITHIN DOD.

33. COST OF STANDARDIZATION EFFORT WITHIN DOD.

34. STIMULATE INCREASED QUALITY COMPETITION IN THE ACQUISITION OF TECHNICAL MANUALS.

35. WHAT MAKES A BETTER PROCUREMENT DATA PACKAGE?

36. ASSIST IN ESTABLISHING A GLOSSARY OF TERMS. COMPLETED

37. ESTABLISH CURRENT STATISTICS FOR DATA THROUGH OSD.

38. ACCELERATED ACTION TO IMPLEMENT AIA, NSIA, AOA RECOMMENDATIONS.

39. NSIA TECHNICAL SYMPOSIUM. COMPLETED

40. MONITOR THE "ESTABLISHED RELIABILITY" SPECIFICATION PROGRAM.

41. THE ESTABLISHMENT OF INDUSTRY ASSOCIATION ADVISORY COMMITTEE. COMPLETED

42. DEFERRED ORDERING OF TECHNICAL DATA.

43. SIMPLIFY DRAFTING PRACTICES.

44. DEVELOP FIVE-YEAR PROGRAM FOR SPECIFICATIONS AND STANDARDS.

45. ESTABLISH A POLICY ON PART NUMBERING.

46. STUDY THE PROBLEM OF LIMITED COORDINATED SPECIFICATIONS.

47. DEVELOP DOD POLICY ON PREFERRED PARTS LISTS AND THEIR APPLICATION IN INTRA-SYSTEM STANDARDIZATION.

48. DEVELOP POLICIES AND IMPROVE PROCEDURES TO FURTHER INTRA-SYSTEM STANDARDIZATION.

49. ACCELERATED ACTION TO IMPLEMENT CONGRESSIONAL RECOMMENDATIONS.

50. EXPAND APPLICATION OF 26-WEEK COORDINATION PROCEDURE TO MORE SPECIFICATIONS.

51. IMPROVE ENGINEERING DRAWING MANAGEMENT.

52. REVIEW THE PROBLEM OF THE QUALIFIED PRODUCTS LIST.

53. EVALUATE DEFENSE STANDARDIZATION MANUAL M200 TO DETERMINE NEED FOR NEW DOCUMENT.

54. REVISION OF TDSPC CHARTER AND SUBCOMMITTEE TERMS OF REFERENCE. COMPLETED

55. DEVELOP KEY MANAGEMENT INDICES FOR OTDSP (MOOT PROJECT).

56. DEVELOP DOD INDEX OF TECHNICAL MANUALS.

57. DEVELOP DOD TECHNICAL MANUAL STYLE GUIDE.

58. ESTABLISHMENT OF THE OSD AUTHORIZED DATA LIST.

59. EVALUATE COMPUTER AIDED DESIGN AND DOCUMENTATION.

60. STANDARDIZATION STUDY OF ENGINE GENERATOR SETS.

61. SUPERSONIC TRANSPORT - EXCHANGE OF TECHNICAL INFORMATION. COMPLETED

62. SPECIFICATION STANDARDIZATION PROGRAM PLAN.

THE MANY FACES OF MIL-D-1000

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The title to this presentation of mine is, to my mind, incongruous. One might conclude that suggesting the specification has many faces it is "two-faced". This is by no means so. But let me take but a moment or two to explain the development of the "many faces" theme. When I was first queried about making this presentation, it was recommended that I speak on source control and specification control drawings. Being a born coward I refused. I suggested instead, what I considered an appropriate title. I called it "The Many Facets of MIL-D-1000". My colleagues on the AOA Steering Committee somehow managed a circumlocution of the title and out came "The many faces of MIL-D-1000". C'est-a-dire!

Why then the many faces? Or, the many facets? The specification is designed to do many jobs for many people. It's a situation akin to a tool box. One reaches into a tool box for the tool one needs to do the job. And if I remember my apprentice training, one always uses the right tool for the right job.

How did it get this way and why did it replace MIL-D-70327? The MIL-D-1000 has its genesis in the congressional report of the subcommittee of the Committee on Appropriations, House of Representatives (the Mahon Committee Report); the Department of Defense Conference on Technical Data Management (the Aberdeen Conference); and, the DoD Instructions 5010.11 and 5010.12.

I can bore you to tears quoting book and verse as to the specifics of the MIL-D-1000 birth. Suffice it to say the reasons are few and simple. The congressional report I mentioned placed emphasis on acquiring technical data adequate for competitive procurement, acquiring it in a prompt fashion and acquiring only that data which is necessary, and insuring the adequacy of the data delivered by contractors to the DoD.

The Honorable Thomas D. Morris, the then Assistant Secretary of Defense for Installations and Logistics at the Aberdeen Conference of 5, 6 and 7 May 1964, in his keynote address to the confrerees, emphasized the fact that we in the Departments had to apply to the management of this so-called software (engineering documentation in this case) the same basic principles that have been effective in managing the acquisition of hardware. This has been paraphrased to "We manage our data in the same manner we manage our hardware".

To implement the above, the DoD issued two instructions. DoD Instruction 5010.11, "Improved Management of Technical Data and Logistics"; and DoD Instruction 5010.12, "Determination of Requirements and Procurement of Technical Data and Information". These two directives in concert with the findings of the Mahon Committee and the decisions of the Aberdeen Conference as prompted by Secretary Morris' declarations gave direction to the Working Group charged with revising MIL-D-70327 and the result: MIL-D-1000.

How did the two instructions affect the development of the specification? They set rigid guidelines for the acquisition of engineering documentation. These guidelines? In brief, they are in the DoD Instruction 5010.11, "Data shall be procured only when the need is justified, and data documentation requirements shall be itemized on appropriate forms to make known the specific intended use, the quantities required, and the precise identification of the required data". In addition, DoD Instruction 5010.12 states as its objective: To acquire most economically the minimum amount of data needed to procure and support the military systems, materiels and services; to specify data requirements in solicitations for bids or proposals in sufficient detail to provide a basis for a full, clear, and firm understanding between the Government and the contractor with respect to the total data requirements at the time the contract is placed; to maintain quality assurance procedures in the acquisition of technical data to assure the adequacy of the data for its intended purpose; to prevent the acquisition of duplicate or overlapping data pertaining to materiel, systems or services when data which would serve the same end use has been or is being acquired by the Government from the same or other contractor.

The Instruction specifically decrees that "data requirements shall be determined on the basis of intended use of the data, with careful consideration of the immediately planned and probable future use of systems, materiel, or service to which the data relates" and provides guidelines for the establishment of Intended Uses. It further admonishes the Departments that, "Only such data shall be acquired from contractors as is necessary to satisfy intended use". It specifically requires that: "All data requirements shall be selected from Department or Agency Authorized Data List and shall be justified as to essentiality and these requirements shall be documented on a DD Form 1423, Contractors Data Requirements List". The guidance for Form 1423 completion within the Instruction requires that "The adequacy of technical data and information submitted in fulfillment of contractual data requirements shall be determined prior to acceptance and payment therefor by the Government. Determination that data is complete, accurate, and in compliance with applicable specifications and standards shall be confirmed by an acceptable contractor quality control system and competent Government surveillance and review".

What does all this say? In every day English devoid of gobbledygook, the Departments and Agencies of the DoD are directed to predetermine their data requirements and select from an authorized data list the kinds of data that will best satisfy their needs, list these requirements on a Form 1423, in sufficient detail to provide a basis for a full, clear and firm understanding between the Government and contractor, and insure that submitted data meet the stipulated requirements prior to acceptance.

How best to implement the directives as to provide for uniformity throughout the DoD. Use a specification! Thus, the MIL-D-1000. But why a specification. The directives, the Mahon Committee Report and the Aberdeen Conference concern themselves with the acquisition of data, and a specification is an acquisition instrument. Then again, the directives have within them requirements that lend themselves nicely to specification coverage and thus provide for DoD uniformity.

A specification answers the requirement for "sufficient detail to provide for a full, clear, and firm understanding". By defining category content in terms of design disclosure, it provides a selection of categories and forms to enable proper selection based on a predetermination of need; it provides the quality assurance provisions for use in "determining that data is complete and accurate prior to acceptance"; and, as the specification allows for the use of existing drawings when they meet the design disclosure requirements ordered it "prevents the acquisition of duplicate or overlapping data when such data has been or is being acquired", and the category and form combinations lend themselves to Departmental listing on an Authorized Data List.

It should by now be evident the categories and forms are the tools in the Data Managers tool box to enable him to satisfy the requirements "That only such data shall be acquired . . . . as is necessary to satisfy intended use".

There are enough goodies within the MIL-D-1000 to satisfy all the Departments and Agencies of the Department of Defense. One thing must be made unmistakably clear at this point. The tool box and the tools are the property of the Government Data Manager. He is responsible for determining the intended use of the data that will be acquired. He is the only one in possession of the facts to make this determination and he is bound to document his judgment on a Form 1423 and make his selection from an Authorized Data List which, for engineering drawings, selects the category and form required from the MIL-D-1000 specification.

And why this intermix? To satisfy intended use. Why so many intended uses? This is a big operation,this Department of Defense that pays my salary.

The product mix in the Department of Defense in hardware alone runs the gamut of everything from shoelaces to missiles with the requirements that Departments acquire and, in most instances, maintain this mass of hardware. And, like a well stocked Department Store, its shelves also carry software. Engineering drawings that document design decisions, interface restraints, design restraints, etc.

The Armed Services Procurement Regulations (ASPR) very well defines the reason for the peculiar interest the Government has in data and the reason for these directions to the Departments in the preparation and acquisition of these data. The ASPR reason is well worth repeating as it, in conjunction with the DoD Instructions, forms a very effective framework from which a Data Manager operates. The reason for this may well be formed into a Data Manager's creed and it reads: "The Government has extensive needs for many kinds of technical data. Its needs may well exceed those of private commercial customers. For defense purposes, millions of separate equipment and supply items, ranging from standard to unique types, must be operated and maintained, often at points remote from the source of supply. Functions requiring varied kinds of technical data include training of personnel, overhaul and repair, cataloging and standardization, inspection and quality control, packaging and logistics operations. Data resulting from research and development contracts must be obtained, organized and disseminated to many different users. Finally, the Government must make technical data available in the form of contract specifications in order to obtain competition among its suppliers, and thus further economy in Government procurement". These then are the words of todays Gospel according to St. ASPR.

The MIL-D-1000 document meets all the requirements of the ASPR qualification; the provisos of DoD Instructions 5010.11 and 5010.12; it satisfies the admonitions of the Mahon Committee; and meets Secretary Morris' recommendations of managing the software in the same manner that hardware is managed. We treat it like a commodity!

Now let me change the theme.

Now that I have satisfied the "why" of the specification, let me take you through its application in an everyday business climate. First, the interrelationship of the MIL-D-1000, its supporting document MIL-STD-100, the directives that are the foundation of the specification, the uses to which the specification resultants are placed and a new management technique that uses the specification in its requirement for engineering drawings. I show you this for it is essentially the situation that faces a data manager. So, understanding his job, you might better understand the reason for the data requirements that eventually appear in contracts.

As the graph illustrates, and as I have earlier indicated, MIL-D-1000 has its roots in DoD Instructions 5010.11 and 5010.12. These same Instructions direct the Government Data Manager into certain set courses of action. The MIL-D-1000 has a supporting document, MIL-STD-100, Engineering Drawings and Associated Lists. This plays an important part in one particular area of the specification and I'll discuss it in its proper place.

The specification provides for 3 forms and 10 categories, of engineering drawings. The possible combination of these are the tools in the Data Manager's tool box. With these, he can service, as the need requires, the life cycle of the item he is responsible for supporting. However, he has a few other tools in his kit. If it suits the intended use, he can acquire existing drawings that meet the design disclosure content for the specified category and are not in the form as originally required. He weighs the costs and the ability of the drawings to serve the intended use and makes a decision. If he accepts an existing drawing package for support of his requirement, he advises the contracting officer of the resultant change and indicates a decrease in contract costs should be considered.

The categories also give him reign in selecting the type of drawing package he needs to serve a specific use. In many instances the Data Manager may only have a requirement to buy data for support of a design evaluation or an interface control situation or he might be confronted with a new management technique called configuration management and be required to develop data for identification as a management baseline. His selection is a flexible one. He uses the tools that best fit his problem. He can select a category that will provide him with data useful only for design evaluation and control of interface incident to design; or data specifically intended for test, installation or maintenance; and if he intends subsequently to reprocure the hardware the data describes he limits himself to Categories E and F, the only categories available to him for product procurement support. His flexibility is equally evident in the selection of the form in which the drawing shall be acquired. If his requirement is such that he only wants data for design evaluation and does not intend to use it for any other purpose he may order a form 3 drawing and be content with it. The contractor in preparing this kind of drawing may use his in-house drafting systems, identification, etc. and be concerned with the drawing content and legibility of the data.

Or on the other hand his situation might be such that the hardware for which he is acquiring the data is such that its intended use indicates a long logistics life for the item with an equally long reprocurement program. He now has no alternative. He must select the category and form combination that will best insure him data that will be capable for unrestricted competitive procurements.

Armed with his back-up information he makes his decision, category E and F drawings.

It's very possible that competing contractors in their response to an invitation for bid might offer a category and form combination other than requested on the form 1423. The Data Manager takes these factors into consideration and uses them in the assignment of evaluation points for the evaluation factors used in determining the successful bidder. He may elect to pay a premium for these kinds of data as he is aware that the total life of the data and its use in the procurement system will more than offset the increased data cost in reduced total cost for hardware because of having adequate data on hand for competition.

Then again, the Data Manager might be involved in a system design situation wherein configuration management principles are applied. His requirements are such that he has to provide engineering data for the establishment of a definition baseline, a development baseline or a production baseline in accordance with specifically designated configuration management procedures. The flexibility afforded by the form and category combination of MIL-D-1000 stand him in good stead. He may not need engineering drawings in his data package for the establishment of the definition baseline but his product is such that he requires engineering drawings for the establishment of a development baseline or for control of design interfaces if the weapons system is such that design responsibility is divided among design agencies.

However, as the designer approaches the production baseline, the Data Manager may require different combinations of forms and categories to do a complete data job. He does this by selecting category and form combinations best suited for his projected intended use or uses of the hardware. Enough visibility is provided within all Departmental configuration management systems that, in conjunction with phase performance contracting, the Data Manager in concert with a Project Manager can provide direction to the contractor through the contracting officer as to the combination of form and category of engineering drawing required for coverage of a specific equipment or condition.

This then is a thumbnail course in the diverse paths that a Data Manager may trod in his efforts to meet the directions that guide him and his work. It's similar to the instructions provided to DoD Data Managers at the Air Force Data Manager's School but devoid of most of the details of proper category and forms selection. Obviously, in the few minutes allotted to me, I can but scratch the surface as to the various ways individual design conditions and situations might be translated into engineering drawings using the many faceted MIL-D-1000 and its companion document MIL-STD-100.

Permit me to recap. What is the MIL-D-1000? It's the tool box for use by Departmental Data Managers and capable of translation into Departmental Authorized Data Lists. It has within its framework something to meet most engineering documentation conditions that might confront a Data Manager. If mistakes are made, and the improper data is acquired, the fault cannot and should not be placed on the specification. It is only the tool box. What has happened in most instances is that the mechanic - in this instance a Government Data Manager - has selected the wrong tool from the tool box, or worse, a contractor has handed him a non-standard tool not suited to his particular job, and the D.M. is stuck with a hammer that won't drive the nail or a wrench that won't fit the bolt.

To continue, it's the responsibility of a Government agent - presumably a

Data Manager - to make known the Government's requirements in language such that both the contracting officer and the contractor are equally knowledgeable and fully conversant with the requirements.

In closing, the Government Data Banks in the future will only be as good as the judgments of Government agents define the kinds of engineering data required, and Government Quality Assurance personnel, or their designated representatives, accepting only such data that meets the definition of the data ordered.

Presumably, mismanagement of the specification could develop into making it a "many faces", or two-faced document causing a dis-service to both the Government and the contractor. What might appear on the surface to be a cost saving situation could prove eventually to be penny wise and pound foolish and ultimately require the addition of more funds into a redraw or redesign program, or a fate worse than infidelity - inadequate data!

AIR CE FILM
ENGINEERING DATA MANAGEMENT

Jack L. Flippo
Chief, Contractor Data Management Office
HQ. Air Force Logistics Command

The Air Force presented their recently released film on the program for Deferred Ordering of Engineering Data. The program, as outlined in the Air Force film, is designed to present a new approach to how engineering data might be ordered on an as-required basis by the Air Force from its contractors. The objective of the film is to highlight for industry and government activities, how, by using the contractor engineering data files, duplication of efforts by the contractor and Air Force are eliminated; as well as the costs associated with the receiving, inspecting, storing, and reproducing of multi-sets of data. The program is designed to provide flexibility so that an activity can order drawings, either for a one-time use or a continuing use with the contractor providing new and revised drawings as they occur. Essentially, the film tells the story of how the contractor provides the services, which the Air Force formerly accomplished for itself, after acquiring a "complete" set of data. It covers the priority for delivery, services that are available, inspection, and the approval system for the data.

Mr. Flippo, in his introductory remarks, advised that the film was only cleared for this one official public showing by the DoD, that it is now in the process of being approved for release at HQ USAF and the Department of Defense. He advised that upon official release, AOA, Mr. Weissbrod, will be advised of how copies may be obtained in accordance with AFM 95-4.

AIR FORCE IMPLEMENTATION OF MIL-D-1000

Mr. Paul R. Durr
Chief, Data Documentation
Directorate of Supply
HQ. Air Force Logistics Command

It is a pleasure to participate at this meeting, being held to stress data management. Stressing the importance of data management, as a part of sound system management, is of particular interest to me. This has been, and is, one of my major responsibilities within the Air Force - particularly where engineering data are concerned.

My subject is Engineering Data Management, but more specifically, the Air Force implementation of Military Specification MIL-D-1000. The acquisition of engineering data being a part of the overall Air Force Data Management Program, is encompassed in Air Force Regulation 310-1, and the Joint Systems Command and Logistics Command Manual 310-1.

The Air Force implementation of Specification MIL-D-1000 is incorporated in Revision "E" to the joint AFSC/AFLC Manual 310-1, Volume II, covering management of contractor data and reports. Specification MIL-D-1000 was prepared and released to more accurately select only those data which are essential to government needs, and to relax where possible, requirements for their preparation. Since the Air Force had adopted this concept under the contractor data management program, there is no significant change in concept between the data acquisition documents which implemented MIL-D-70327, and those which now implement Specification MIL-D-1000.

In presenting the Air Force implementation of Specification MIL-D-1000, I will address comments to some of the more significant changes which have been made during implementation of Specification MIL-D-1000, and relating these changes to past practices.

The data acquisition policy of the Air Force is to acquire only minimum essential data needed, provide direct submission to the user for one-time needs, store and maintain only those data for which there is a recurring requirement, and maintain continuous control and evaluation of contract requirement. This has been and will continue to be accomplished, by selecting the data requirements from an authorized data list, entering the minimum essential requirements on the DD Form 1423, and making continuous reviews and updating the DD Form 1423 to reflect current needs.

The current revision of the Category "E" Section to AFSC/AFLCM 310-1 has two new sections to more accurately determine the essential needs in implementing Specification MIL-D-1000, and most important to industry, a standard method for citing the requirement.

The two new Sections are a Matrix, and a Special Instruction and Guidance Section. The Matrix is an alphabetical listing of missions which require use of engineering data, cross-referenced to the Form 9 data item which covers the engineering data requirement and invokes MIL-D-1000.

The Matrix also covers drawing preparation requirements, and provides for selection of the Form 1, 2, or 3 type drawings. The Special Instruction and Guidance Section identifies peculiarities of a data item, such as; it has multiple requirements and you will indicate in the Remarks Block of the DD Form 1423, which requirement applies, or, the item of supply to which the requirement applies must be entered in the Remarks Block to effect the data requirement.

An example of how this works can be explained by referencing Data Items E-105 and E-107.

a. Data Item E-105 covers five separate mission requirements which use a Category "A" package of data as defined in MIL-D-1000. These missions are identified in the Matrix and the Instruction and Guidance Section requires the person completing a DD Form 1423, to identify which paragraph of Data Item E-105 is applicable to the contract.

b. In the case of data item E-107, a data requirement is effected only when the DD Form 1423 identifies the hardware to which the requirement applies. The person completing the DD Form 1423 must enter in the Remarks Block of the DD Form 1423, the hardware to which the requirement will apply.

The person or persons determining the engineering data requirements for entering on the DD Form 1423, follows six (6) basic steps through use of the Matrix and the Special Instruction and Guidance Section.

a. In Step 1, the preparation requirements are determined. That is, whether Government document numbers will be assigned to the data, or whether contractor document numbers will be assigned to the data, and whether Form 1, 2, or 3 type data will be ordered. Making this decision, as Step 2, the appropriate data item or items covering the preparation of the data to be acquired are entered on the DD Form 1423.

b. In Step 3, the data items prescribing engineering data to be furnished to support mission performance will be determined. When the data items have been identified, the fourth step is to refer to the Special Instruction and Guidance Section, to determine what notations, if any, must be made on the DD Form 1423 to assure acquisition of minimum essential data.

c. In Step 5 the hardware to which the requirement applies is determined from information stated in Special Instructions.

d. The last step is to enter the Data Item on the DD Form 1423, citing the applicable reproduction and delivery requirements, and entering any other special notations as directed by the Special Instruction Section.

The requirement for preparation of engineering data under Specification MIL-D-1000, provides for their acceptance to a variety of drafting systems and standards. Contract requirements for preparation of engineering data may well differ throughout the military, as a result of this flexibility. The Air Force, as I am sure most of you know from experience, has more or less applied this concept over the past few years.

Determining what drafting standards would or would not be accepted by the

Air Force was generally based on the type of contract, the kind of hardware being acquired, the degree of management to be applied to the hardware, and the hardware control necessary. To explain: The Air Force required in specific cases, full compliance with military specifications and standards now identified as Form 1 drawings in Specification MIL-D-1000. The Air Force will continue to require full compliance to Form 1 requirements under Specification MIL-D-1000, in those same instances where full compliance of Specification MIL-D-70327 was previously required. Examples are: When Air Force drawings are prepared with Government assigned document numbers, and when the Air Force is paying for development of the item and/or data.

The Air Force provided for acceptance of contractors existing engineering data and drafting practices with identified hardware control requirements, very similar to what Specification MIL-D-1000 now identifies as Form 2 drawings. The Air Force in implementing MIL-D-1000, has maintained this same policy, but addresses the Form 2 format to existing data for those data to be acquired in support of maintenance and reprocurement missions.

The Air Force has, where conditions existed that did not require engineering data to be prepared to requirements of Specification MIL-D-70327, and did not require specific hardware control, accepted "Best Commercial Practices" as a contract requirement for drawing preparation. This is now identified and defined as Form 3 type data in Specification MIL-D-1000. The Air Force will address requirements in the future to Form 3, where "Best Commercial Practices" were factually acceptable in the past.

The drawing preparation requirements for implementation of MIL-D-1000 is covered by three separate data items. One data item will cover the preparation of data when Government document numbers are assigned. These requirements will be addressed to Form 1 data only. The second data item covers requirements for preparation of engineering data when contractor document numbers are assigned. These requirements are addressed to Form 1 but conditions are established for acceptance of Form 2. The third data item provides for preparation of engineering data to the Form 2 or 3 format at the contractors option, and will be used when the data item requiring delivery of data authorizes or provides for the Form 3 format.

In those cases, where Form 1 drawing practices are required, there have been some additional requirements added. These additions represent certain requirements the Air Force determined to be essential which were not included in Specification MIL-D-1000 or MIL-STD-100, but were included in the cancelled documents.

The Air Force, through negotiations with prime contractors, identified what the drafting requirements and practices of a contract would be. If a requirement was relaxed or otherwise changed, words, appeared in the contract to state what the requirement was. This practice will continue whenever Form 2 data are acquired in support of hardware which is procured and managed by the Air Force. A contract is only as good as the stated requirement with a suitable method of enforcement, and a way to measure the product for acceptance. In the opinion of the Air Force, simply stating Form 2 or Form 3 does not in itself state a firm requirement to the contractor. There would not be a firm contract requirement to measure against or to enforce, if data received could not be used for the purpose intended, because of preparation. The Air Force can not assume this risk as part of sound system management where hardware control is necessary.

In implementing Specification MIL-D-1000 for drawing preparation, requirements for preparation of Form 1 data are fully defined in the data item. The acceptance of Form 1 data versus acceptance of Form 2 data, when hardware control is necessary - what practices will be acceptable and in what situations the Form 2 requirements for limited controls can be applied are fully defined.

The criteria for Form 3 data is different, only to the extent that it is intended that the recipient, or the requiring activity, is aware of the engineering data to be acquired and has predetermined prior to application of the Form 3 requirement, that what the contractor has, can in fact, be accepted and used.

The Air Force will make realistic decisions in applying requirements for preparation of engineering data, and will further direct these decisions to cover both the prime contractor and vendors.

Vendors have in the past complained with respect to data preparation requirements, and being forced to continually change their practices because of contract requirements negotiated for a prime contractor. An example in this area is where the authorized data item for drawing preparation was re-written for a particular contract to accept a prime contractor's system. Vendors who were preparing data in accordance with the authorized data item, as a result of other contracts, had to change their requirements to those of the new contract. To preclude this happening in the future, personnel are being instructed to enter both data items on the DD Form 1423. A data requirement, negotiated on behalf of the prime contractor would be addressed to the prime contractor, with the standard authorized data item being addressed to vendors.

The basic coverage for acquisition of engineering data is the same for Specification MIL-D-1000, as was implemented for Specification MIL-D-70327. The data items have been renumbered, however, there is a data item for each of the major missions as in the past and new items have been added to provide for a broader range in selection of essential data. The basic difference in a data item is that in lieu of the data item identifying the engineering data to be furnished for support of a given mission, the data item now states that a Category A, B, or C package shall be furnished in accordance with MIL-D-1000, whichever the data item covers.

The Air Force expects, under Specification MIL-D-1000, for a design activity to prepare a complete design disclosure set of drawings for his manufactured item. This set of drawings to be prepared in accordance with drawing preparation requirements stipulated in the contract. It is further expected that the set of drawings would include engineering data only; that is, drawings, specifications, standards, and lists.

When a data item appears on the DD Form 1423 such as E-105, E-106, or

E-107, the contractor and vendors are expected to select from the prepared set of engineering data, those which are necessary to satisfy the intended use. It is not expected that existing data be redrawn to limit information furnished, or that other data such as technical orders, engineering reports, etc., which may also be needed to perform the stated mission, be furnished as a part of the package. Should any data or documents other than engineering data be required to support the mission, another data item for the type of report or document needed, will also be entered on the DD Form 1423. The point is, that only engineering data will be required and will be furnished under a category "E" (Engineering Data) Data Item.

It may be necessary, because of contract terms or conditions, that a separate piece of data will have to be prepared from time to time which was not a part of the original set of drawings. For example, for reprocurement data, in lieu of selecting from or providing the complete set, a specification may be prepared, or specification control drawing may be required and prepared, which otherwise may not have been prepared by the contractor as a part of the original set of data.

The areas of most concern to the Government and to Industry, with respect to engineering data are the reprocurement and the maintenance mission requirements.

It must be recognized and emphasized that engineering data are mandatory requirements for maintenance and fabrication. The present tolerances in high performance weapon systems must be delineated on engineering data by the contractor, and these must be subsequently transmitted to the Air Force for use in various mission categories, particularly for maintenance responsibilities and reprocurement. Drawings, Specifications and Standards must have a common frame of reference that can be transmitted to any Air Force activity, with the assureance that they can be interpreted and utilized for their intended purpose. Parts, assemblies, and subsystems of high performance weapon systems, can not tolerate substandard data, particularly when configuration management, interface, and other hardware controls are invested in the drawing preparation standards.

Contractor drawings are utilized by all echelons of military and civilian personnel within the Air Force system. In today's environment, time is a primary factor. Time lost in trying to interpret a design activities peculiar drawing system, or to decipher symbology referenced on drawings other than the standards, can not be tolerated. It is for these reasons that Air Force contracts will be specific in citing drawing preparation requirements, particularly when the requirement is addressed to weapon systems and hardware to be procured and maintained within the Air Force.

The data item covering Air Force requirements to support maintenance missions, covers three separate requirement conditions. The data item requires for airframes, missile frames, training equipment, engines, and aerospace ground equipment that complete data will be furnished. The data item defines the complete data to mean the set of data which was prepared and/or defined in the data item covering the drawing preparation requirements. The data item requires delivery of this complete set or requires that it be retained current at the contractor's plant under a deferred ordering concept. The deferred ordering concept referred to is where the contractor retains the data within his files and copies of individual drawings are requisitioned from the contractor on a need-to-have basis until final delivery for retention by the Air Force.

A provision is also covered to acquire the complete data for any other hardware item when the item is identified on the DD Form 1423 as requiring complete data. The major reason for this provision, is to acquire new and revised data to update complete data previously acquired for an item. When complete data had previously been acquired and is being used, it is more practical to continue to update this package of data than to require a contractor to identify only those data which are required to support a specific mission requirement, and update only a portion of the set.

The third provision is to acquire only those data needed to support the technical orders acquired for the maintenance concept. This data package is identified as the Category H & I package of data defined in MIL-D-1000. In this particular instance, we expect a design activity to review the maintenance concept and the technical orders he has prepared to support this concept for his hardware. He would then furnish only those data from his complete set, which are necessary to supplement the technical orders. The package would also contain the detailed drawings for each spare and repair part source coded for local manufacture by the Government.

The engineering data required in support of reprocurement missions are basically the same under MIL-D-1000 as previously stated in the superseded data items. There are two data items under the implementation of Specification MIL-D-1000 covering reprocurement data, in lieu of the three data items previously used. Each data item provides for both the Category E and F Packages of data defined in Specification MIL-D-1000. One data item is for end items and the second is for spares and repair parts of the end items.

The data item for spares and repair parts is predicated upon the method for reprocurement of the spare or repair part. Therefore, the data item requires the Air Force to identify the spares and repair parts for which reprocurement data are required. There are two ways this is accomplished. The procurement method coding procedures of MIL-STD-789, which are invoked by Data Item P-14, and the transaction code 1309 Federal User data cards.

a. The new spares and repair parts being introduced into the system will be indentified through source coding, and the category of data requirements through the MIL-STD-789 process.

b. The remainder of spares and repair parts will be identified upon receipt of 1309 Federal User data cards. These cards are received by the contractor from the Defense Logistics Service Center. This card will identify the previously established procurement method code and thus identify the type of data package, Category E or F, to furnish or to update.

The spares and repair parts coded 6 for open competition under Data Item P-14, will require delivery of design disclosure data for the competitive procurement. This is defined in Specification MIL-D-1000 as Category E. Those which are coded 7 for selected source procurement, will require the category

F data as defined in Specification MIL-D-1000. Those which are coded 8 for Sole Source Procurement, do not require under the new data item, delivery of reprocurement data. Source control drawings are however required within procurement data packages for end items. These data, upon receipt by AFLC, are prepositioned to the procuring AMA for subsequent use in reprocurement of the spares and repair parts. Insofar as reprocurement data requirements are concerned for assembly type end items, except as noted on the DD Form 1423, reprocurement data will be acquired for each item the government intends to procure for stock. The requirement is addressed to a Category "E" package of data, except in those cases where contract terms and conditions preclude acquisition of design disclosure data for reprocurement purposes. When these conditions exist, Category "F" or form, fit, and function type data are acquired.

The engineering data support requirements which were formerly covered by separate data items have taken a new look, with implementation of Specification MIL-D-1000. The preparation requirements as we have covered are encompassed in three separate data items in lieu of two.

The data item for reproductions has been eliminated, as well as the data item for tabulating cards. Reproduction requirements are now a part of each data item, and with exception of microfilm requirements, the requirement is so written to accept the type reporductions used by the design activity furnishing the data.

A new data item has been added for preparation of a list to identify and control data shipments. This data item applies to those data items pertaining to maintenance and reprocurement - the list will be used to identify data ordered, contracted for, deliveries and recording of data receipts.

Throughout the Air Force, engineering data are considered as everybody's tool. Drawings are a primary factor from the start of any design, to the termination of its production and use. Upon receipt into the Air Force system, items are provisioned to, maintained with, supplied from, and reporduced from engineering drawings. Engineering drawings are the pictorial delineations that convey engineering intelligence. They must bridge the gap between the designer and the manufacturer of the product, and must speak a universal language so that they may be submitted to a user with full confidence that any resulting product is as the designer envisioned it.

The engineering data specialists, must continually maintain surveillance over data requirements to assure that obligations to Air Force data users are maintained. In 1959, industry and military working together, achieved one of the most important standards of our time - MIL-D-70327. The Air Force does not desire to lose the benefits or competence of this standard. Where engineering data were concerned, MIL-D-70327 was a vital tool to sound systems management. Substandard data will fall short of the mark, and is of little or no value to data users.

Twenty years ago we had drafting systems and requirements based on the type of hardware. In 1956 the Air Force published its first consolidated standard, MIL-D-5028. In 1959 a single standard became effective for all of DOD, - MIL-D-70327. Today, the standard is MIL-D-1000. A single standard is now up to industry. MIL-D-1000, if you let it, can revert to what we had 20 years ago, or you can maintain the quality of standards under MIL-D-1000, which were achieved under MIL-D-70327. Mr. Industry - what will you have?

I want to thank the Management of this meeting for the opportunity to be here today and make this presentation, and to thank all of you for being such a good audience. - - Thank you.

B. WEDNESDAY AFTERNOON SESSION - APRIL 27, 1966

INTRODUCTION

This section contains the following papers, reports and panel sessions presented on Wednesday afternoon; Presiding Chairman, Grant D. Christensen; Recording Secretary, Joseph V. Symanoskie.

G.D. CHRISTENSEN
PRESIDING CHAIRMAN

J.V. SYMANOSKIE
RECORDING SECRETARY

T.C. PRITCHARD

J.W. ROACH

F.M. GRIMES

CAPT. F.C. LAW
USN

LT. COL. W.H. MASON
USAF

H. HOLLAND

A.W. SNODGRASS

D.W. DUNN

B1

PRICING OF ENGINEERING DATA

By: Tram C. Pritchard

I appreciate the opportunity of appearing before you today. However, I can't say that I feel fortunate in my assigned choice of subject. While I re-adjust my armor plate, let me hasten to assure you that I come to bury the project not to raise it.

This is my second bout with the topic - "The Pricing Of Engineering Data." The first was the assignment to prepare the original text of what is now Attachment 5 to DOD I-5010.12, originated on the basis of developing actual cost data on engineering documentation. As I am sure you are all aware, this has since been re-oriented and, justifiably so, from actual cost to estimated cost of data.

The first assignment on this subject was as chairman of an ad hoc group of the Drawing Practice Industry Advisory Committee, charged with the requirement to prepare an instruction on the accumulation of actual costs of engineering data. The majority of the members of the ad hoc group reacted quite violently in opposition to the task in making strong recommendations that such an instruction was not desirable and would serve no useful purpose either for the Dept. of Defense or for Industry. After two attempts to influence the discontinuance of the task - one on 13 March 1964 and again on 17 May 1964 - we were advised that we were expected to perform the task as charged.

Following this, utilizing some of the minority comments, what I referred to above as the original version of Attachment 5 was prepared and presented to the Technical Information & Logistics Data Committee on 15 June 1964. The presentation was accepted on the basis that some minor changes would be made prior to co-ordination within the Dept. of Defense and with Industry.

I have watched with interest the subsequent co-ordination of the instruction, and it was no surprise that it was finally converted from actual cost accumulation to estimated cost.

It was with no little apprehension last May that I accepted the chairmanship of a sub-section on this subject and agreed to make it the topic of my presentation at this meeting. Subsequent reaction has served to strengthen my conviction that any attempt to re-orient what is now accepted would be a serious mistake. It is clearly evident that Industry feels that the obstacles in the way of segregating, accumulating, and controlling the actual cost of engineering documentation and related technical data are so varied and complex, due to variations in organizations and accounting systems, any results gained would be extremely expensive and of somewhat doubtful validity for use in contract management. This is brought about by the fact that every company must be ingenious and creative in responding to the characteristics of the business environment in which they operate. The nature of their business, their facilities, and the philosophy of individual managers, as well as many other factors pertinent to their conduct of a competitive business.

Let's take a look at the reason for data pricing. Since technical data is a major element in the management of the development, acquisition, and support of weapon systems and equipment, there must be assurance that essential data are obtained to serve their intended purposes.

To accomplish this effectively requires a careful and detailed analysis of the system or equipment concerning its construction, the mission it fulfills, the environmental and the operational conditions under which it will function. This analysis can determine the data needs that will range from "essential" to "handy to have". The application of economical factors to the selection requires a cost effectiveness study for each data item or package. Pricing information provides the key tool for this cost effectiveness evaluation. Since accumulated actual costs would be after the fact, only before the fact estimated prices are sufficiently timely to support the cost effectiveness evaluation. This must be a valued consideration in support of the presently established Attachment 5.

There are certain types of engineering data on which actual cost is customarily accumulated in sufficient detail to support an assessment of their cost. I am speaking here primarily of manuals and certain types of reports that are normally prepared in final form by separate organizational units. This does not represent a problem area, either for actual cost accumulation or for cost estimation. The gray area that becomes difficult in either direction is that data where there is no clear cut division between development and preparation. Certain types of Test Reports, Design Evaluation Reports, and Specifications fall into this category. The prime ingredient in this category is, of course, the engineering design drawing. Certain types of drawings are clearly design effort as opposed to documentation effort. Mechanical layouts, Space Allocation Drawings, and in many cases Electrical Schematics serve only as a design tool and do not define manufacturing or operational considerations. Separation of the development effort and the documentation effort in the types of drawings that are considered as part of the data package, is most difficult, due to organizational variations, due to contractual variations, due to schedule conditions, and many others.

I mentioned contractual conditions. An example of this is the series of contracts wherein the original effort is development and production of prototype units with no data requirements established. The subsequent production contract, then, requiring data delivery. At this point the only action necessary to convert the data from prototype (under which it was not considered as a separate element) to production where it is being considered in such light, is to remove a digit in the drawing number signifying prototype and the addition of a manufacturer's code number.

The question occurs as to what is the cost of documentation under these conditions. Actually, the question is inconsequential since the data developed under these conditions was essential to the production of the prototype hardware and was not effected by any peculiar, or special, requirements imposed by the customer. The example only serves to point out the difficulty in establishing a clear cut line of demarkation for establishing data values. It is readily apparent that each contract must be treated on its own.

There are many arguments that could be offered against changing our present course in establishing data values. But the one that is as yet largely unrecognized, yet will have the most resounding impact in this area, is the approaching technology of Computer Aided Design. In this approaching era, documentation in many instances will fall out as, literally, a free by-product; it will assume forms as yet undefined; it will be transmitted by means not yet employed. Yet, this technological era is approaching so rapidly that it will be effectively employed in many large industries probably more rapidly than we could change the rules we are here discussing today.

A group of military, industry, and academic people has been established to maintain awareness of the progress of this technology and to recommend appropriate controls sufficient to support its acceptance.

In view of the above discussion, I wish to recommend to this section that we perendinate any action by the Data Pricing sub-section, and that any reference to actual data costs in the sub-section charter be stricken. Let's wait and see what the future brings and devote our efforts toward making what we now have work.

My appreciation to you gentlemen who responded to my correspondence in support of this sub-section project. Hopefully our next project together will be of a more amicable nature.

Thank you.

DOD CONCEPTS
OF
CONFIGURATION MANAGEMENT

By: James W. Roach

The purpose of this presentation is to discuss the rationale and the objectives of a configuration management discipline; to describe the major features of the discipline as it is presently conceived and to illustrate the relationship of this discipline with the categories of RDT & E, procurement practices and technical and business management practices.

Slide 1, Definition: What is Configuration Management?

A. A discipline applying technical and administrative direction and surveillance to: (1) properly identify functional and physical characteristics of an item, (2) control changes to these characteristics, and (3) record change processing and implementation status.

B. A Defense materiel item is used as a generic term connoting a specific hardware entity or a combination of hardware considered as an entity such as a system, subsystem, facility, equipment, commodity, part, material, or process.

Slide 2, Rationale: Why do we need Configuration Management?

A. Identification and control of the configuration of Defense materiel items are needed in order to effectively develop, produce, support, and operate these items.
   1. Not a new "cult".
   2. A tool of project management <u>and</u> R & D management.

B. Guidelines for identification coverage and completeness are needed to assure consistency of identification with each life cycle stage of the item.
   1. SYSTEM Performance Specifications.
   2. Performance Specifications for element of the system.
   3. Detail Design Specifications.
   4. Detail Design Drawings.

C. Guidelines for Configuration Control are needed in order that all echelons within the Defense Acquisition Community may participate as demanded by the situation.
   1. OSD/DOD Component Interface.
   2. R & E/I & L Interface.
   3. Development/Logistics/Operations.
   4. Supply/Maintenance.
   5. DOD/Industry (or in-house equivalent).

Slide 2, Rationale: (Continued)

D. A discipline is needed to support and enhance the effectiveness of other policies and disciplines which depend directly or indirectly on configuration of an item.
   1. Procurement Practices
      a. Breakout
      b. Second Source
      c. Total Package
   2. Management Information and Control Systems
      a. TDP
      b. SAIMS
      c. CIR
      d. PERT
   3. Integrated Logistics Support

Slide 3, Objectives: What are we trying to accomplish?

A. To provide the level of configuration identification, control, and status accounting necessary to assist management in achieving the required item performance, operational efficiency, logistics support and readiness.

B. To allow the maximum appropriate degree of design and development latitude yet introduce progressively the degree and depth of control necessary for development and production.

C. To attain maximum efficiency in the management of changes with respect to the cost and timing of processing, content, evaluation, implementation and recording.

D. To attain the optimum degree of uniformity in configuration management policy, procedures data, forms and reports at all interfaces within the DOD and between DOD and Industry.

E. To accomplish configuration identification, control and accounting in a manner that provides a sound technical base for other management techniques.

Slide 4, Major Features of Current DOD Draft.

A. Application
   1. Tailored to needs of all Defense materiel items.
   2. Applied in progressively detail to increasing lower levels of indenture as design and testing matures.
      a. Performance Specifications for System.
      b. Performance Specifications for System elements.
      c. Detail Design Specifications and Drawings.
   3. Level of indenture limited to that required for reprocurement, breakout and repairability.
   4. Commercial items treated as commercial items.
      a. Form, Fit and Function.
      b. Details available but not controlled.

Slide 4, Major Features of Current DOD Draft (Continued)

5. Initiated at start of Engineering Development or whenever the item is first considered for DOD procurement.
   a. Systems and equipments at start of Engineering Development.
   b. Commercial items - first at initiation of test proceeding Production buy.

Slide 5, B. Responsibility
1. Single point control in DOD
   a. Project Officer assisted by Configuration Manager.
   b. Functional Office Director.
2. Joint service Project control through single individual.
3. Planning before initiation of Project.
   a. Who
   b. What type
   c. How

Slide 6, C. Audit before Acceptance
1. Characteristics Demonstration
   a. Functional in Development or before Production buy.
   b. Physical in Production with limited functional.
2. Documentation Demonstration - Documentation matches the part.

Slide 7, D. Identification
1. Both functional and physical configuration identification required.
2. Identification consists of baselines plus approved changes from baselines.

Slide 8,
   a. Baseline I - Functional
      1) System Performance Specifications.
      2) Design Constraints and Interfaces.
      3) Environmental Conditions.
      4) All Defense materiel items.
      5) Start of Engineering Development or start of test proceeding Production decision.
      6) May include certain items which are under their own product baselines - highlighted under design constraints.

Slide 9,
   b. Baseline IA - Allocated Configuration
      1) Major Configuration Element Performance Specifications.
      2) Same as 2 through 6 above.

Slide 10,
   c. Baseline II - Product
      1) Detail Design Specifications, and Drawings and Associated Lists.
      2) Form, Fit and Function Specifications and Drawings for commercial or for nonrepairable and noncompetitive reprocurable items.
      3) No joint use in contract of Baseline I and IA with Baseline II.
      4) No use of Baseline I or IA in lieu of Baseline II once design and test is approved and accepted.

Slide 11, E. Control

1. Definition of Control
   a. Not no-change policy.
   b. Not all-alike units.
2. Definition of Changes - all configuration changes, waivers and deviations.
3. Governing Documentation
   a. Within DOD - all configuration identification approved to date.
   b. Between Industry and DOD - latest approved configuration identification.

Slide 12,

4. Change Control Criteria - significant benefit.
   a. Correct errors or deficiencies.
   b. Meet approved changes in operational or logistic support requirements.
   c. Effect substantial net savings to Government.

Slide 13,

5. Evaluation
   a. Evaluated on basis of the net benefit of the change.
      1) Technical Improvement or Degradation.
      2) Cost Improvement or Degradation.
      3) Schedule Improvement or Degradation.
      4) Logistic Improvement or Degradation.
      5) Operational Improvement or Degradation.
   b. Evaluated against all configuration identification approved to date.
   c. Consider impact on all application of a change to a multi-application item.
   d. Standards on processing times with audit backup.
   e. Decisions made by management echelon in accordance with thresholds established in other policies.
      1. Programming 7045.1.
      2. TDP System.
      3. Integrated Log Support System.

Slide 14,

6. Accounting - the recording of configuration identification including delineation of baselines, status of proposed changes, status of implementation of approved changes both to configuration identification and to the hardware.
   a. Recorded data - only that for which there is a positive need.
      1) Proposed Changes.
         a) ECP Identification.
         b) Responsibility and schedule for processing.
         c) Log of progress in processing cycle.
         d) Disposition of the ECP.
      2) Approved Changes.
         a) Change identification and effectivity.
         b) Identification of affected configuration elements, their location and quantity per location.
         c) Implementation responsibilities and schedule.
         d) Implementation kits, quantities, deliveries and schedules.
         e) Change documentation, its schedules, delivery points.

Slide 14, E.6. (Continued)

3) Affected Areas
   a) Contracts
   b) Identification
   c) Manuals
   d) Spares/Retrofit/Modification Kits
   e) Tooling and Test Equipment
   f) Support Equipment
   g) Training Equipment and Data
   h) Facilities
   i) Packaging

Interfaces: The interface of configuration management with other disciplines and policies can best be illustrated by running through a simple example. The example chosen is the development and initial production of an aircraft. During the presentation of the example, I will highlight those points in the cycle where certain alternative approaches are appropriate if the item being considered is other than an aircraft or similar large, complex project requiring extensive development activity.

Slide 15,

A. Background
1. Extensive intersystem and intrasystem studies and possible experimental work effort during Advanced Development and particularly during the Concept Formulation of Advanced Development on the specific system chosen.
2. At point 1, the DOD Component is requesting approval to proceed into Engineering Development, starting with Contract Definition if necessary.
3. Request to proceed, backed up with a proposed system item performance specification.

B. Approval to Proceed (at Point 1)
1. Approval establishes Baseline I, the system performance specification.
2. Baseline I; governing documentation for Contract Definition and/or Engineering Development.
3. Projects for which No Contract Definition would proceed directly into proposal effort, negotiation, award and Engineering Development - governed by Baseline I plus any performance changes approved as a result of proposal and negotiation.

Slide 15, (drop 1),

C. Contract Definition
1. Governed internally to DOD and contracturally by Baseline I.
2. May result in limited series of performance specifications for major elements of the system/item. This is Baseline IA.
3. May also result in certain approved performance changes which are reflected both in Baseline I and in Baseline IA.
4. Proposal and negotiation effort of non-Contract Definition projects could and do achieve the same results.

Slide 15,(drop 2), D. Engineering Development

1. Governed internally in DOD by Baseline I plus approved changes.
2. Governed contracturally in one of three ways:
   a. Baseline I plus approved changes if contract is for entire system under a system specification, or
   b. Baselines I and IA plus approved changes if contract is for entire system but under a major element performance defined by specification, or
   c. Baseline IA if DOD Component is system integrator and major elements are contracted to series of associate contractors.
3. Our example illustrates the single prime with a systems contract governed by Baseline I plus approved changes.
   a. Development Design
   b. Development Fabrication
   c. Development Assembly
   d. Development Test

Slide 15, (drop 3), E. Production

Ideally, late in development test, we could proceed with production by establishing the product Baseline II, Point No. 3 on the slide, releasing a contract for production against Baseline II and proceeding to operational inventory, except for two major considerations.

1. Lack of a production engineered design, and
2. The need for some concurrency which forces production consideration long before the end of the development test.

Slide 16, F. Production Considerations

Let me illustrate these points. This slide has the same development by a prime contractor.

Slide 16, (drop 1),

1. Shortly after start of design release, engineering change traffic commences.
   a. Tooling Changes
   b. Manufacturing Changes
   c. Initial Test Changes
2. Under performance baseline and specification, the majority of change traffic is associated with Class II physical characteristics or Class II performance changes within the system or major element performance envelope.
3. Traffic generally builds to a peak during assembly of first few units and during early test and then tails off, but never completely.
4. The curve appears, generally, to be the pattern for all types of materiel items.

Slide 16, (drop 2), G. Approach to Solution

1. One possible approach:
   a. Production Engineering inherent in development contract with major design changes incorporated in development models for validation test.
   b. Late in development test, production data package available which has been engineering tested; however,
   c. Data package has not been proven in production. Suggest then that developer be given limited production run at Point 3 against Baseline II to demonstrate producibility of data package.
   d. This is in line with considerations of the total package procurement.
   e. Problems are still inherent in this approach since the Government is taking responsibility that data package is producible by using Baseline II as governing documentation for first production buy.
      1) Possibly could be eliminated by accepting last few developmental units against the proposed Baseline II.

Slide 16, (drop 3),

2. Second Approach - Concurrency Approach
   a. Release limited production against current system performance specification or major element performance specification to original developers.
   b. Developers do a production engineering design job with significant changes being incorporated into developmental models for test.
   c. At the offering of first article for acceptance, developer also offers proposed Baseline II which has been audited against hardware progressively by the Government inspector.
   d. Also, at the time of first article acceptance, development testing must have progressed to the point that key performance and key integration of system elements has been achieved.
   e. Acceptance of first article by the Government formally establishes Baseline II, and all future units on the production contract are accepted against Baseline II not performance requirements.
   f. Change control on second and subsequent units switches from performance characteristics to physical characteristics down to the level of WBS necessary for repairability and/or competitive reprocurement.
   g. Problem still inherent in this approach is reduction of excess risk to contractors if development testing runs into severe problems and reduction of risk to Government stemming from proliferation.
   h. Second approach has several advantages:
      1) Early production release capability if needed.
      2) Increased latitude in design for production to contractors.
      3) Reduced risk and reduced administration for Government by later establishment of Baseline II.

Slide 17, H. Second Production Run, Breakout, Provisioning, etc.

1. Obvious that maximum benefit received to these activities if initiated after Baseline II establishment.
2. Planning for maintenance, training second source, provisioning and breakout can be initiated during production engineering design or even following development design.
3. Development test can produce valuable data on spares needs and rates and particularly on the controlling low MTBF part or component which governs the maintenance act and consequently the availability rate.
4. Implementation of planning can start immediately following the establishing of Baseline II.

Summary

A. Touched on:

Rationale
Major Features
Data Management
Interfaces
Remaining Problems

B. We still have much work to do!

DEFINITION

A DISCIPLINE APPLYING TECHNICAL AND ADMINISTRATIVE DIRECTION AND SURVEILLANCE TO (1) PROPERLY IDENTIFY FUNCTIONAL AND PHYICAL CHARACTERISTICS OF AN ITEM, (2) CONTROL CHANGES TO THESE CHARACTERISTICS, AND (3) RECORD CHANGE PROCESSING AND IMPLEMENTATION STATUS.

Slide 1

RATIONALE

- ENHANCE DEVELOPMENT, PRODUCTION, OPERATIONS AND SUPPORT
- ASSURE CONSISTENCY OF IDENTIFICATION FOR EACH LIFE CYCLE STAGE
- PROMOTE EFFECTIVE PARTICIPATION OF ALL ECHELONS
- SUPPORT OTHER POLICIES AND DISCIPLINES

Slide 2

OBJECTIVES

- ✓ CONFIGURATION MANAGEMENT TO A PROPER LEVEL
- ✓ DESIGN LATITUDE YET INCREASING DEFINITION AS DESIGN DEVELOPS
- ✓ EFFICIENCY IN CHANGE MANAGEMENT
- ✓ PROPER UNIFORMITY IN PROCEDURES
- ✓ SOUND BASE FOR OTHER MANAGEMENT TECHNIQUES

Slide 3

APPLICATION

- TAILORED TO ALL MATERIEL ITEMS
- PROGRESSIVE DETAIL AS DESIGN AND TESTING MATURES
- DETAIL LIMITED TO REQUIREMENTS FOR REPAIRABILITY AND REPROCUREMENT
- COMMERCIAL TREATED AS COMMERCIAL
- START WITH ENGINEERING DEVELOPMENT OR FIRST DOD PROCUREMENT

Slide 4

RESPONSIBILITY

- SINGLE POINT CONTROL IN DOD
- SINGLE POINT CONTROL FOR JOINT SERVICE PROJECTS
- PLANNING BEFORE INITIATION

Slide 5

AUDIT BEFORE ACCEPTANCE

- CHARACTERISTICS DEMONSTRATION
- DOCUMENTATION DEMONSTRATION

Slide 6

IDENTIFICATION

- BOTH FUNCTIONAL AND PHYSICAL IDENTIFICATION REQUIRED
- IDENTIFICATION IS:
  BASELINES PLUS APPROVED CHANGES

Slide 7

BASELINE I - FUNCTIONAL

- ITEM PERFORMANCE SPECIFICATION TO INCLUDE:
  - DESIGN CONSTRAINTS
  - INTERFACE REQUIREMENTS
  - ENVIRONMENTAL CONDITIONS
- ALL DEFENSE MATERIEL ITEMS
- INITIALLY AT START OF ENG'R DEVELOPMENT
- MAY INCLUDE CERTAIN ELEMENTS UNDER THEIR OWN PRODUCT BASELINES

Slide 8

BASELINE I A - ALLOCATED

- PERFORMANCE SPECIFICATIONS ON MAJOR ELEMENTS OF AN ITEM TO INCLUDE:
  - DESIGN CONSTRAINTS
  - INTERFACE REQUIREMENTS
  - ENVIRONMENTAL CONDITIONS
- USED ON THOSE ITEMS WHERE LIMITED BREAKDOWN OF AN ITEM IS DESIRABLE

Slide 9

BASELINE II - PRODUCT

- DETAIL DESIGN SPECIFICATIONS AND DETAIL DESIGN DRAWINGS PLUS ASSOCIATED LISTS.
- FORM, FIT AND FUNCTION FOR COMMERCIAL, NON-REPAIRABLE AND NOT COMPETITIVELY REPROCUREMENT.
- NO JOINT USE OF BASELINE I AND II.

Slide 10

CONTROL

- CHANGES: ALL ECP's, DEVIATIONS AND WAIVERS
- GOVERNING DOCUMENTATION:
  * WITHIN DOD - ALL CONFIGURATION IDENTIFICATION APPROVED TO DATE
  * BETWEEN DOD AND INDUSTRY - LATEST APPROVED CONFIGURATION IDENTIFICATION

Slide 11

CONTROL CRITERIA

- CORRECT ERRORS OR DEFICIENCES
- MEET APPROVED CHANGES IN OPERATIONAL OR LOGISTIC SUPPORT REQUIREMENTS
- EFFECT SUBSTANTIAL NET SAVINGS TO GOVERNMENT

Slide 12

EVALUATION

- NET BENEFIT OR CHANCE
- CONSIDERATION OF ALL APPROVED IDENTIFICATION
- PROCESSING TIME STANDARDS
- DECISION IN ACCORDANCE WITH ESTABLISHED THRESHOLDS

Slide 13

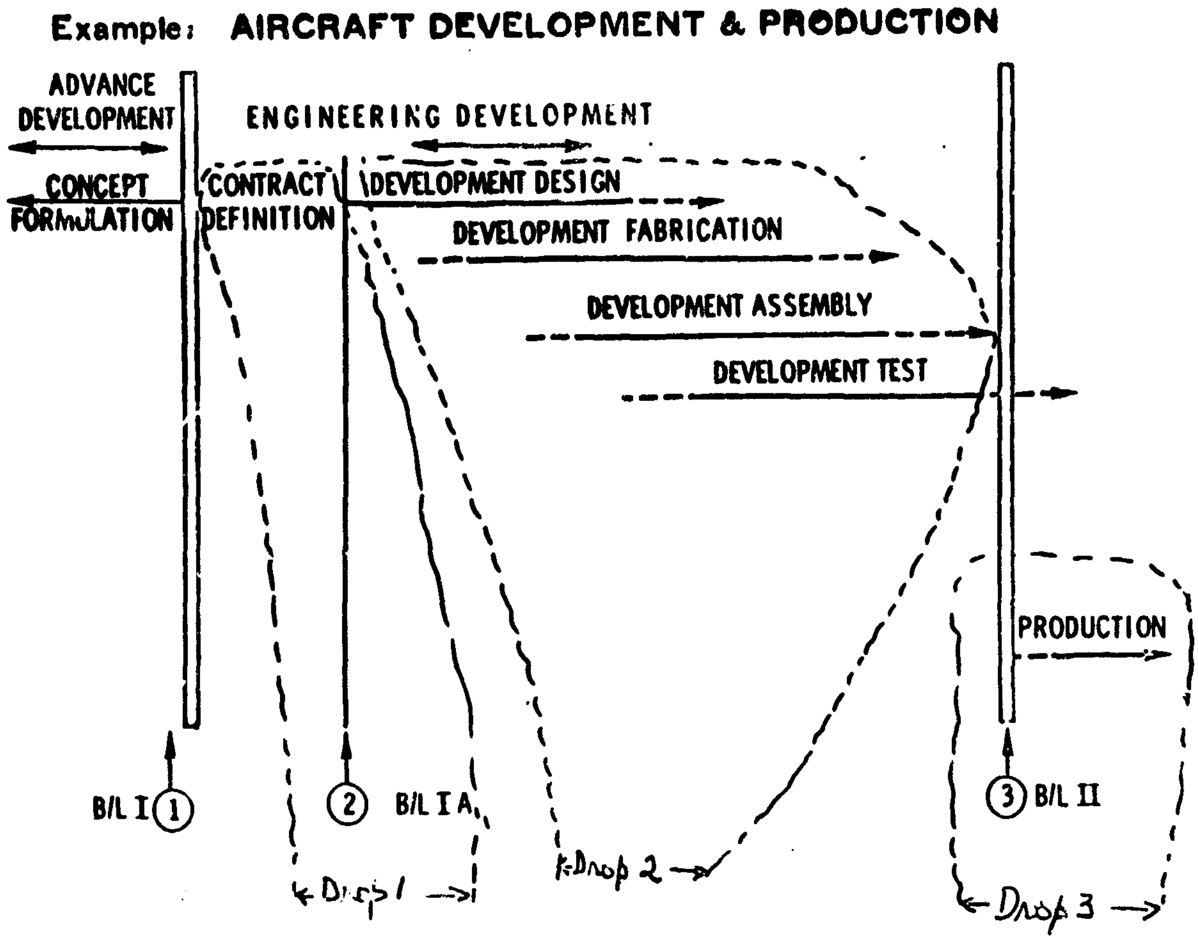
ACCOUNTING

RECORDING OF:
- BASELINES
- ECP PROCESSING
- CHANGE IMPLEMENTATION

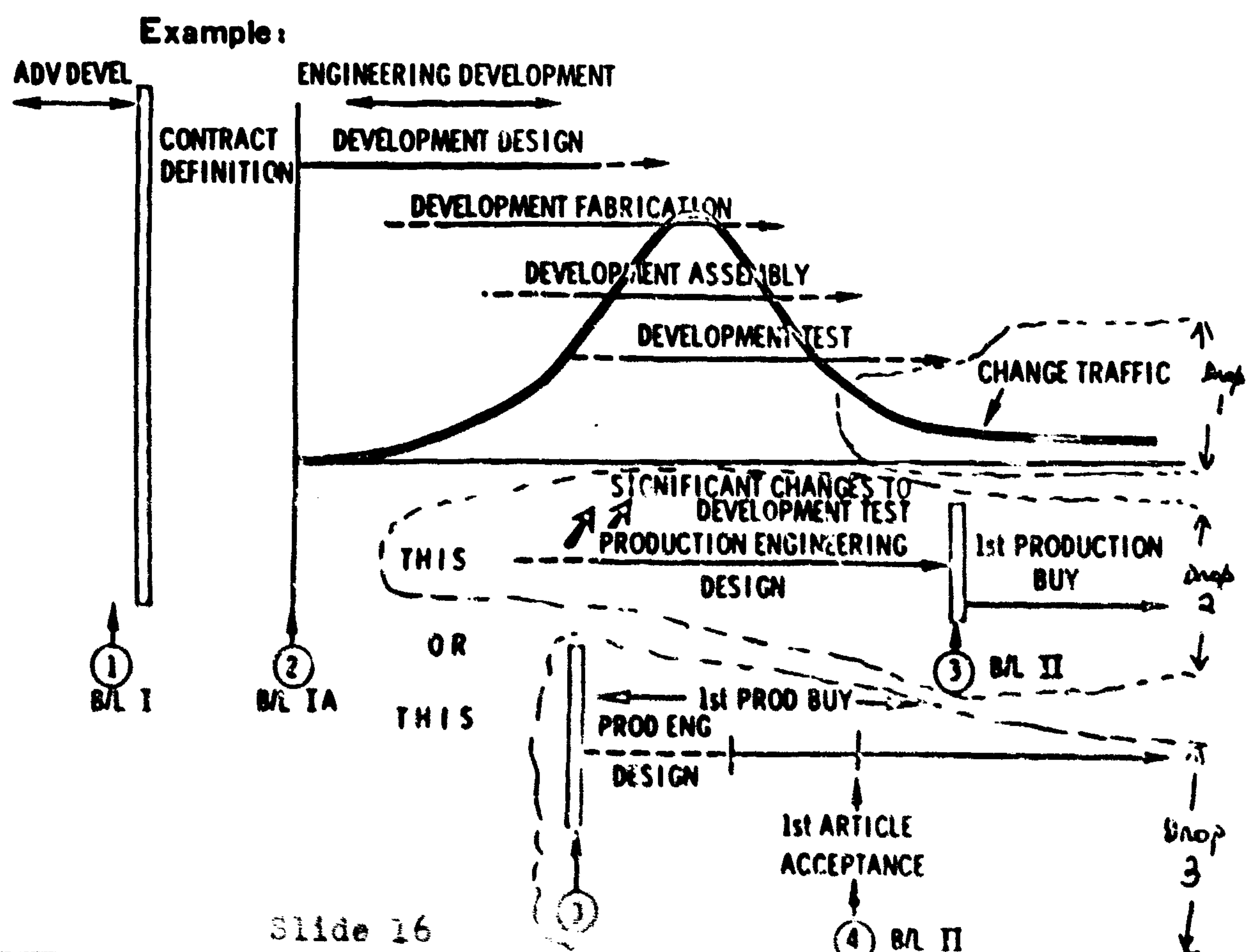
DATA
- PROPOSED CHANGES
- APPROVED CHANGES

AFFECTED AREAS

Slide 14

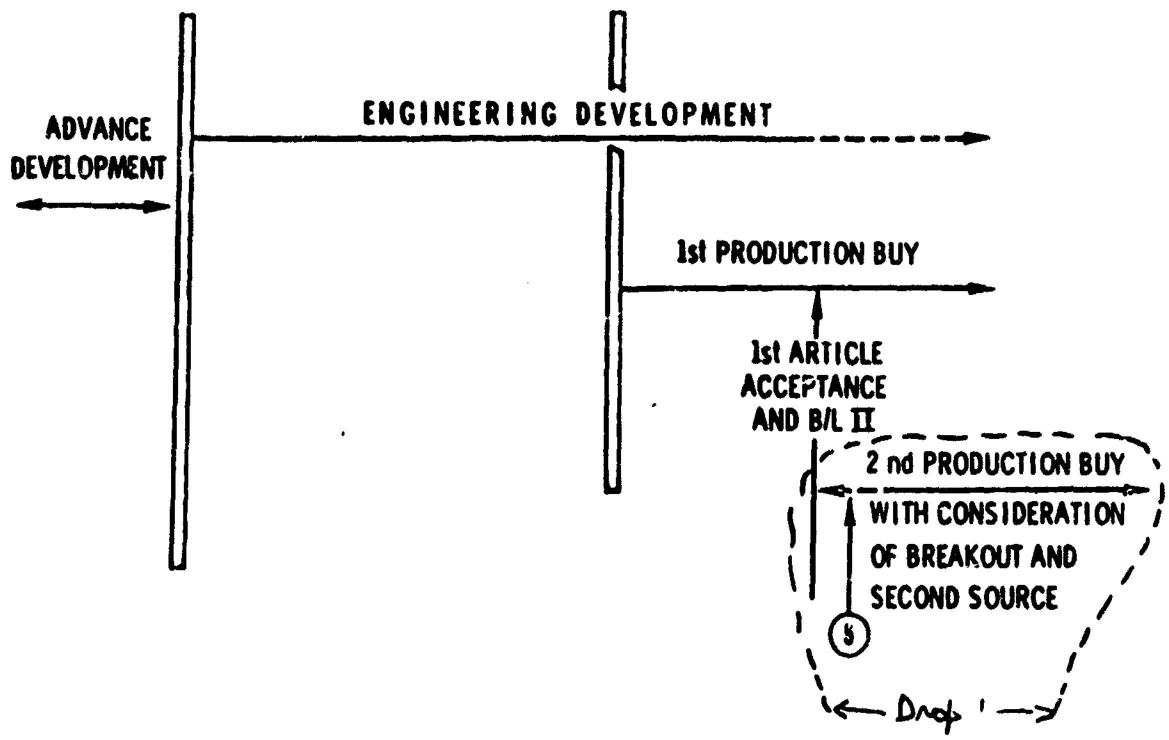


Slide 15



Slide 16

Example:



Slide 17

CONFIGURATION MANAGEMENT PROGRAM OF THE AMC

By: Fenner M. Grimes

Gentlemen:

Please do not get the impression that Configuration Management is a new idea. It is a relatively new term covering procedures which have been in existence, in varying degrees, for many years. Within the Army, many commands and installations have been practicing Configuration Management without using the term, but I am afraid there has been very little consistency in their method of approach. Those of you that have been working for or dealing with the Army for a number of years are probably familiar with what has been known as the Arsenal Concept. In the early arsenal days there was very little concurrency, and most design, test, preproduction engineering, and even production, in some cases, was done in-house. The distinguishing feature was in-house control of all engineering changes.

Another system of control has been used by the Army Missile Command. Here there has been a great deal of concurrency due to the efforts to close what was popularly referred to as the "missile gap". Practically all of the effort was contracted, and considerable latitude was given the contractor; perhaps too much in some cases, although controls have been tightened considerably in recent years.

When the Army Materiel Command was established in 1962, to assume the logistics functions of the Army, General Besson inherited all of the diversified equipment and management systems which had developed under the Technical Services. Obviously, it was a problem of considerable magnitude to weld all of this into a smoothly functioning organization and it was not possible to change, overnight, ways of doing business which had developed over years. However, General Besson has tackled the problems in order of priority, and is making real strides in accomplishing his major objectives.

Since Configuration Management is an important discipline for minimizing some of our logistics problems, he directed about 2 years ago that something be done to develop reasonably standardized procedures to accomplish the objectives, and still permit his subordinate commands sufficient flexibility to accomplish their mission. The result of this effort was the Army Materiel Command Regulation 11-26, which was approved in June of last year. The task group which prepared this regulation had the benefit of the Air Force efforts to develop their manual 375-1, and there is a great deal of similarity in the end products, even though the terminology and some of the details differ.

Configuration Management is defined as "A formal concept by which the physical and/or performance parameters of materiel systems and equipment are identified, controlled, and recorded throughout the life cycle".

When we say identified we are speaking of specifications and drawings. When we say controlled we mean that all changes in the specifications and/or drawings will be subject to comprehensive review prior to approval, and approval will be given only when there is a real need or benefit. When we say recorded, we mean that we will have a data bank containing all of our specifications, drawings, and engineering changes representing the configuration of the item at any given point in time. Thus the importance of technical data in configuration management is obvious.

We consider Configuration Management and Technical Data Management as disciplines which assist in the accomplishment of an objective. The objective must be kept in mind at all times, so that we will not get too involved in a discipline just for the sake of the discipline.

The objective is the same as the objective of all Army logistics management programs; that is, to make sure that the combat soldier has the best possible equipment, has it at the right place at the right time, and has everything he needs to operate and maintain the equipment. To do all of this we need paper as well as hardware.

Usually when we develop a new, and better piece of equipment, we plan to buy it in quantity. To do this we need technical data. When we are checking out the equipment to see that it does what it should, we again need technical data as a standard against which to evaluate its performance. When we deliver equipment to the troops, they need instructions as to how to operate it and maintain it properly; again we need technical data. When equipment is developed and manufactured, there is a practical limit as to its inherent reliability. When it breaks down we want to be able to repair it in the shortest possible time. For this we need the repair parts, the right tools, and clear, concise instructions, which, again, are technical data. When we are designing new equipment, the tendency of the project leader is to concentrate on meeting or exceeding the performance requirement. The other disciplines just get in the way, as far as he is concerned, particularly such tiresome details as documenting all changes and the reasons for them as he goes along. However, if this is not done, we are liable to end up with inadequate maintenance and repair instructions, or parts that don't match the equipment. This is what Configuration Management is trying to avoid. I cannot emphasize too much that control of changes is the heart of configuration management, and is essential to adequate logistics support. Although the data required for support of change proposals may, at first, seem excessive, the decision process for changes must consider the total cost of the change throughout the life of the equipment, not just the immediate cost in procurement. Only those changes that show an overall cost saving, or are necessary to fulfill the operational requirement should be approved.

Time does not permit my giving you a complete run-down on the procedures we use within the Army Materiel Command to implement our Configuration Management concept. Suffice to say, we firmly believe that the basic philosophy is the same as proposed by OSD and, I believe, by our sister services, and that the proper implementation of these philosophies will be beneficial, both to the Government and Industry. We intend to keep our procedures as flexible as is consistent with reasonably standardized methodology.

Since our regulation has been in use for less than a year, we are still in the process of debugging it. As you all know, the written word does not always mean to the reader, exactly what was intended by the writer. We feel, however, that we have provided enough flexibility that any impact on Industry will be minimal.

While the DOD Directive, as presently drafted, will require us to revise our regulation, no major change in concept is anticipated, and once the terminology is understood, it should not have any major impact on your way of doing business with the Army.

Thank you.

STATUS OF NAVY CONFIGURATION MANAGEMENT PROGRAM

By: Captain Frank G. Law

Navy Introductory Comments for a panel discussion on Configuration Management at the Eighth Annual Meeting of the Engineering Documentation Section of the American Ordnance Association, 27 April 1966. Presented by Captain F. G. Law, USN, of the Office of Naval Material.

In response to the requests of the moderator of this panel and others of Industry, I will confine my remarks today to the current status of the Navy's Configuration Management Program.

Both Industry and our sister services have shown an interest regarding the Navy's plan and schedule for issuing a manual on the subject of "Configuration Management." This is understandable, since the subject is currently treated in the Air Force Systems Command Manual #375-1 and the Army Material Command Regulation #11-26.

To these inquiries we could only respond simply, and without apology: "The Navy was not ready to issue a manual on Configuration Management." Our aim is to issue such a manual only when we can reflect therein optimized, uniform, and effective policies, procedures, and implementing principles to govern the work of Configuration Management in conformance with those desired throughout DOD. It will reflect the implementation required, both in Industry and in the Navy, which will accommodate to the requirements of "product" management as encountered in the several industrial complexes with which the Navy works.

In February of this year, the Office of Naval Material issued NAVMATINST 5000.6 which established a time-phased plan toward the establishment of a Navy Configuration Management Program. A formal program, not just a manual, aimed at early development and active implementation of a program which will constitute the basis for:

First: Implementing the DOD policies and principles for Configuration Management within the Navy.

In this connection, the Navy's program, of necessity, will be partially dependent upon the rate of progress achieved by the DOD Ad Hoc Steering Group and the DOD Work Task Groups engaged in preparation of a DOD Directive and a series of Military Handbooks and Standards for a DOD Configuration Management Program.

Second: In developing and implementing a system for effective total Configuration Management to provide a complete, accurate and up-to-date configuration data file for the use of the Standard Navy Maintenance and Material Management System (3-M).

In this connection, the 3-M System has the inherent capability for increasing fleet readiness and improving the management of maintenance and material resources at all levels.

Third: Developing and implementing without delay a plan for configuration control in compliance with the "Navy Logistic Support Improvement Plan" (NAVLOGSIP), Objective No. 11.

This plan resulted from a comprehensive review and analysis of Navy logistic support. One of the nineteen objectives for improvement of logistic support was the requirement for configuration control, a necessary part of Configuration Management.

NAVY'S ACTION MILESTONES TOWARD ITS CONFIGURATION MANAGEMENT PROGRAM

A series of time-phased action milestones has been developed which identify the major and supportive actions required in implementing the Navy's Program. For each action milestone, detailed work task requirements have been specified and the responsible organizational elements identified. Principal of the action milestones are the following:

Action Milestone 1A

This milestone calls for Navy support of the DOD Configuration Management Task Groups. We consider this of primary importance as it is anticipated that the DOD Task Groups will develop the framework of a system which can be beneficial to the Navy and the other services. Accordingly, the Navy has pledged its full support for the development of the pertinent Military Standards and Handbooks.

Action Milestone 2A

This milestone calls for the in-house improvement of control of alterations and changes at all levels of command and all phases of applicable functions. It is to include the review and necessary development of procedures and criteria for adequate documentation and evaluation of the life cost of proposed alterations, material improvements and engineering change proposals. This assignment is to include the review and analysis of the BUSHIPS Ship Alteration Program, BUWEPS Aircraft, Ordnance and Missile Alteration Programs, and other bureau, project manager, or office material improvement type programs.

Action Milestone 3A

This milestone calls for the improvement of Configuration Management throughout the concept formulation, contract definition and acquisition phases of new naval warfare systems so that when a system, sub-system, end item, equipment or unit joins the Fleet there will be a definite knowledge of what is on board.

The employment of a "Master Configuration Listing (MCL)" for each new system will be adopted and we are proceeding to implement this concept on certain of our new projects.

This will require (1) a "MCL" supported by complete technical descriptions for each item and single language equipment identifiers; (2) control over all changes and the original configuration (baseline); and (3) accounting over approved changes-vs-actual installed changes and then providing the means of maintaining the original technical descriptions and there-fore the item (baseline) current. Also, required will be the preparation and maintenance of ships allowance lists and tender/repair ship-load lists to ensure timely support.

Action Milestone 4A

This milestone calls for the establishment of a totally integrated Navy configuration file. A central NMSE activity (with mechanized feed-in by supporting field activities) or an integrated system (whereby free and full interchange is attainable) will be required to maintain configuration master files for new construction programs with follow-on integration of maintenance and material management and other logistics support programs within the NMSE. Further, the establishment of necessary procedures will be required for configuration reporting via the 3-M Maintenance Data Collection System, at the Maintenance Support Office (MSO).

Action Milestone 5A

This milestone calls for the review and evaluation of the configuration technical description and status accounting interfaces between (1) the DOD Configuration Management Program, (2) the DOD Technical Data and Information Program, (3) the Federal Catalog Program and (4) the Navy 3-M System.

Mechanization of such records is inevitable and will involve technical data record relationships with mechanized indenture systems.

Action Milestone 6A

This milestone calls for the review of all pertinent material identification methods and their related identification numbering systems as these are currently used in the Navy. The purpose of such review is to determine the feasibility and practicality (including cost effectiveness) of adopting a single language Navy equipment identification system.

DEVELOPMENT OF A NAVY CONFIGURATION MANAGEMENT MANUAL

In the discharge of responsibilities assigned, the Chief of Naval Material will issue and maintain a "Department of the Navy Configuration Manual."

It is anticipated that, within the manual, sections will be developed covering for each of the Material Bureaus (and as prepared and maintained by that Bureau) those pertinent implementing principles and procedures as applicable to that Bureau. Such development will be accomplished following the framework and requirements of the Navy Manual and the applicable mandatory Military Standards. Comprehensive guidance and coverage by the Material Bureaus should also provide for maximum uniformity of procedures wherein a common base (facility, function, organization or capability) can serve multiple needs. Such action will assist in minimizing interface problems, particularly between the Material Bureaus and Designated Project Managers.

The development of the Navy manual and its active implementation will further require the following:

(1) Designation in each Material Bureau of a single focal point for all configuration management aspects to ensure coordinated intra-bureau, inter-bureau and related fleet operation efforts in coordination with CNO and CNM.

(2) Designated Project Managers will be the Configuration Manager for the project.

(3) Designation of Configuration Managers for approved intra-bureau aircraft, ship type or other system or equipment area assignments will be made.

SUMMARY

Configuration Management, although oriented toward "project" management, remains fundamentally a "product" management function. The Navy has traditionally supported the concept, that in the military acquisition of weapons systems, both the Naval user and the prime contractor are product co-managers.

The Navy's Configuration Management Program is presently planned to give full weight to both cost effectiveness and military mission considerations. Responsible Navy personnel, both departmental and field, have an increasing awareness of this program.

As you are probably aware, on 1 May we shift from our current organization to the Naval Material Command with the Material Bureaus becoming six system commands. In the revised organizations, supporting elements specifically responsible for Configuration, Technical Data and Standardization Management have been identified. In fact, at the direction of the Secretary and the Chief of Naval Material, I have been relieved of my other duties and assigned as Director of Standardization and Configuration Management for the Navy. With the establishment of the new Naval Material Command you may look for increased emphasis and action toward a total and effective Navy Configuration Management Program.

B5

CONFIGURATION MANAGEMENT - AIR FORCE

Lt. Colonel W. H. Mason
Systems Program Management
Staff Director
Hq. Air Force Systems Command

Mr. Roach expressed some concern that we may develop a cult concerning configuration management.

Let me assure you, Mr. Roach, that we already have been thru that cycle. We have completely oversold it, over glamorized it and had the biggest fad in town going for a long time, so I hope we do not have to go through it again.

But now, I think we have gotten down to the hard requirements of configuration management-identification, control and accounting that we need. The reason we need them is so that we can get a system, a weapon or a piece of equipment in the field that is operable, maintainable, and can be supported logistically. So, we feel that the procedures we have now for configuration management will do that and we do not know whether they need anymore development, however, we are certainly going to participate in anything more in that regard.

For example, you have a weapon or an airplane or whatever sitting in the field and you have the spare parts there and they do not fit. You have people there who are inadequately trained and have operating and maintenance instructions which are not current. You pretty well know then that you have a problem. You can pretty well determine that it comes from not identifying the hardware and not controlling changes to it.

You must be sure that when you make a change that you do everything that is required concurrently with the change, that is, change your spares, change your operating and maintenance instruction, etc.

So, we think that the set of configuration management procedures we have now will do this and solve this problem. We know we had that problem in the field. That is why they were designed way downstream. If they help us in development all the better, but the mission, the objective, is to get something out in the field that will work and do the defense job.

Briefly then, the status of implementation of configuration management. We have had manuals out now for several years and they have been improved to some extent so, we do have some experience in implementation.

We made a serious mistake I am afraid in trying to implement some new procedures which were slightly different, at least on a going program. Well you can't do this very practically. If it's necessary, you must, but we finally concluded that what you need is to look at your going program, projects, program developments, and see if the procedures are adequate to meet your requirements of operation going downstream. If they are, do not try to change them because this costs money. This is confusing and it doesn't serve any purpose.

So we made a thorough review and wherein the procedures in existence on going programs were adequate, we did not try to ramrod any new procedures. However, for brand new programs, starting from scratch, it is easy to implement your current procedures, it is much easier and is much more effective and we have done so in their entirety on several brand new programs. The C5 for example, the MOL and we intend to do this in the future on the new programs, implement all new procedures leaving the going programs as they are if the procedures are adequate.

We have some experiences already on some of the earlier issues of 375-1. We have at least made a good start in solving the problems in operation. We have not completely solved them, we still get spares that do not fit and we still have people that are not trained, etc., but it is a way of approaching it and we thing we are going to make a lot more strides in this direction.

We still have one outstanding problem however. Many of the programs today are multi-service, F111 for example. Sometimes a program includes NASA and other government agencies and many of them include development which has commercial applications, so the problem that exists today is that we have the lack of standardization on procedures throughout the Department of Defense and throughout government.

That is what Mr. Roach's ADHOC Group is working on, that is what the task group is working on, standardizing procedures which, hopefully, will solve this remaining problem of standardization of configuration management procedures throughout industry and everyone that works with them.

Now just a moment here on the status of our Manual AFSC 375-5 which is entitled Systems Engineering Analysis. You may say, what has this to do with configuration management? Everything, it is available, by the way, from the Government Printing Office today for, I believe, $2.75. This is an analysis process which may be used during definition to break up your stem into its elements and to prepare a set of specifications ch define the allocated functional characteristics baseline whic Mr. Roach mentioned as Phase 1-A.

This Manual has some loopholes in it. We have just been raked over some red hot coals about the use of it. *Time* magazine reported we received 36 tons of paper, I heard it was 70 tons. It was a lot of paper!

We may have misused it, however, we are firmly convinced that the basic concept is sound, that it is a sound approach to system engineering analysis for breaking up your system and this answers the question of what is a CEI, what is a configuration element. This gives you a set of performance specifications which you are going to develop to.

We think it is a very sound procedure, however, we have to agree that perhaps we misused it. It needs some very judicious use, selective application. We, both the government and industry, need to put our very best people on it when we do use it, pending the necessary revisions to establish the selectivity criteria and so on.

This is configuration identification for a system defintion phase. You have to get there whether you have a definition phase or not. You need to state your performance requirement in a specification to develop to, to design to. That is the only identification we see a need for to start development. So, 375-5 is one way. It is a sound way, but whether you use that or not you have to identify so you are going to have to get to that point anyway. A set of specifications, defining the group of end items which make up the system. It is available.

AFSCM Manual 375-1 is also available. It is under revisions and we hope to have it revised by the latter part of the summer. We had planned originally to hold off the revision of AFSCM Manual 375-1 on configuration management until the DoD Directive and its subordinate MIL Standards on configuration management were prepared. However, we thought it best to make a major revision now because we knew it was full of a lot of mistakes which we attribute to the printer. I don't apologize for that.

It had a couple of serious omissions. We see very much a need for an exhibit on interface control documentation. We do not have a good handle on interface control documentation. For the entire system, the system specification serves the purpose, but there are a lot of other interface control documents. Interface control drawings and whatever is required. This exhibit will describe the requirements of interface control documents and will be added to the revision.

Also, someone mentioned computer programs this morning and in terms of data. We suspect that the computer program is hardware. Anyway, we are certainly considering the addition of an exhibit on the subject of requirements for computer programs so that we can get our hands on them and get control of changes to them because once you change, you slip in an IBM card or whatever, it may completely wreck your operation. We see a need for controlling changes to computer programs so that we will incorporate an exhibit on this, I think, describing them as hardware.

Also, I want to point out we have cleaned up all the mistakes, and of course we have to align it now with MIL-D-1000 and MIL-STD-100 because it is out of kilter with those two documents and as I understand it we can comply with them, whereas in 70327 we took exception, I think we made a mistake in this regard, now we intend to implement the drawing practices document.

We have been thru, as Mr. Roach said, several iterations of preparation of standards for configuration identification. We have now a completely smooth, finished draft of a configuration identification standard and we discovered it did not say anything. It just said, Thou shall identify your hardware thru specifications and drawings and markings on parts in accordance with MIL-STD-130. So, it was real easy to get smooth because it did not say anything.

So, I think the thing to be done, as I understand it now, will be to take the configuration identification standard and put it in a DoD Instruction because this is really an instruction to ourselves.

Subordinate to this configuration identification standard would be two standards or some other kind of documents on specifications. We feel that specifications are really the heart and soul of configuration identification. They are the only thing we have during development.

We have drawings after a product baseline but we only control the performance specification during development so that is our identification. So, we are really working on specifications.

We are creating two specification documents, one with the same intended purpose and use as MIL-D-1000 has for drawings. An acquisition document for specifications describing the various types, the forms, the intended uses and all that. The second specification document would be a specification practices document. I believe one of your committees is working on a similar document, I think it is called XYZ basically the same sort of an approach.

Now, whether or not we pick up Chapter 5 from M200 and add it to this specification practices document or to a separate document, or we simply supplement M200 with the necessary types of specifications for system, and for development which are not now really well covered in M200 making clear distinction between a performance specification and a detailed design disclosure specification with a product baseline is not determined. Which way we go is really immaterial.

We will have a consolidated specification practices document and this is a part of the package, the DoD ADHOC Group on configuration management expects to complete the package this summer.

CONFIGURATION MANAGEMENT

By: Hal Holland

Configuration Management in NASA is evolving as a key part of the overall systems management approach taken to conducting major programs. In Apollo, we see the first full scale application of Configuration Management principles and procedures as firm program management requirements. Since the gains that have been, and are yet to be made on Apollo, will set the pace to many future programs, both manned and unmanned - my brief comments on NASA and Configuration Management with its attendant documentation will be in the context of the Apollo program.

The basis document for Configuration Management on Apollo is NPC 500-1, an adaptation of AFSC 375-1, with which we feel it is essentially consistent. A contractor operating under either document should have no difficulty in satisfying the requirements of the other. We are, and will continue to work with Air Force and other Government agencies in an attempt to minimize the differences between major customer approaches. We are currently working with AFSC on an exhibit for software Configuration Management. Configuration Management, as a documented set of principles and requirements (NPC 500-1), was implemented when Apollo had already reached a respectable age. The transition to certain methods and procedures was very carefully made to minimize the impact on their current Center and contractor operations and is still in progress although we have already come a long way.

During the past 18 months NASA Manned Space Flight Centers have made strides in setting up, writing and maintaining technical specification programs which are the foundation of our Configuration Management baselines. Change Control Boards in being at all Centers are the final authorities on approving and disapproving changes. They have given the various managers the needed tool for evaluating and controlling cost, schedule and performance impact on the overall program. Numerous reviews and inspections (such as CDR's and FACI's) have been conducted and have been instrumental in providing program management with confidence that compliance with technical and product requirements is being accomplished. Configuration Management disciplines have been a cornerstone for the introduction of incentive contracting. But it is none the less true that Configuration Management is a system of paper and we must depend on the quality of this paper to provide the disciplined mechanisms for making timely decisions.

In the Apollo Program we find that the importance of the documentation system is reflected in Section 5 of the top level management document - The Program Development Plan - and the emphasis here is on specifications - Apollo's basic technical document. Effective Configuration Management is based on a specification program which commences early in the life cycle and becomes progressively better defined at the Program, Project and System level as well as at the End Item level as the program moves through the Definition and Acquisition Phases. This in itself has been a major undertaking since it has required an analysis of the program to identify manageable pieces of equipment at the End Item level. In addition it has hardened the design requirements and provided the kind of firm baselines against which changes can be evaluated and decisions for approval or disapproval can be made. The specification breakdown has also delineated the levels at which these decisions are undertaken. This is an important difference from Air Force programs, for example, where a single SPO is responsible for the total program. In Apollo there are effectively many program offices, consistent with the

NASA Center structure, and it would be unfeasible for the Apollo Program Office in Washington to attempt centralization of total change control. Accordingly, the Apollo Program Office at Level I exercises change control only when the change impacts the Apollo Programs specification - the topmost specification for the Apollo Program. At secondary levels, as for example the launch vehicle, spacecraft, or launch complex, the control of changes is vested in the Level II boards chaired by the appropriate Program Manager when changes affect the Project Specification. At the tertiary level we find change control responsibility in the hands of the individual Project Managers, for instance, stages and modules, working against the System and End Item Specifications within the purview of the Level III boards.

Formal acceptance of a CEI is accomplished at FACI at which time a correlation of the hardware, specification, drawings, test data, production paper, etc. will be accomplished and an acceptance document signed. And once again we are talking about documentation which must be accurately produced and rigidly controlled, to effectively support the established baselines. Drawing systems in Apollo have varied widely in concept and conformity to MIL-D-70327 both in house and out house and although most of the contracts have been updated to require compliance with the MIL-SPEC, if it was not previously in effect, its implementation has been considered in the light of where we are in time to avoid a wholesale reorientation of the drawing systems. We have made progress in this area through detailed surveys, at our centers and contractors, by pointing out the pitfalls of inadequate drawing practices and poor engineering disciplines.

Once having established Design Requirements and Product Configuration baselines, any changes to those baselines requiring CCB action must be presented to the board at the appropriate level through the standard process -- that is the ECP documentation package. In Apollo this means compliance with ANA Bulletin 445. Apollo Configuration Control Boards are in being and operating at all levels consistent with the specification affected by the change. The boards response at all levels is the Configuration Control Board Directive which is the authorization to take contractual action if the change is approved.

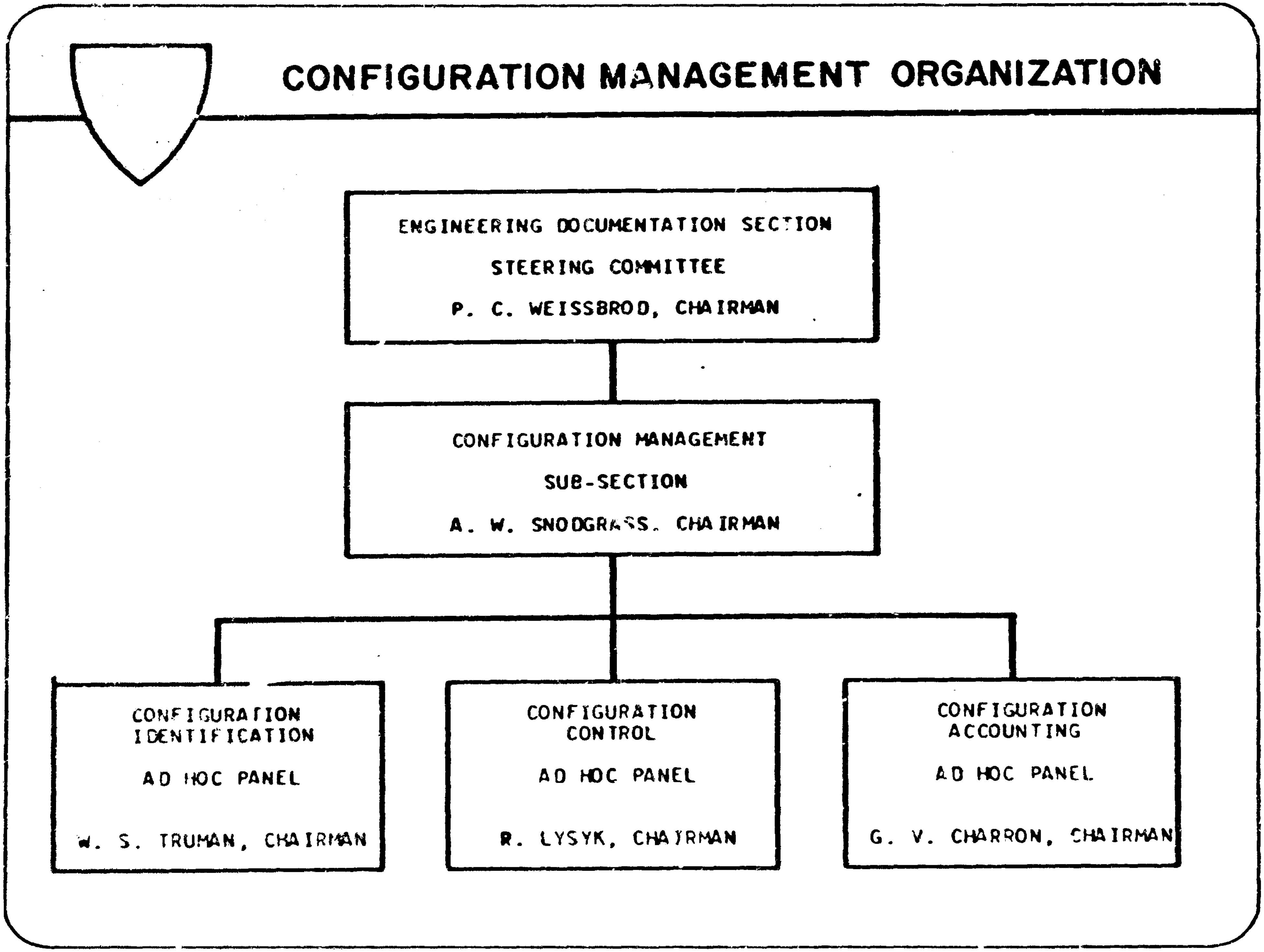
To keep track of all this activity requires some reports the two most significant being the Configuration Identification Index and the Configuration Status Accounting Report. They work together. The former is the official compilation of the baselines for the end items of equipment, expressed in terms of specifications and part members and the record of approved changes to those baselines through the CCB/CCBD activity. It is the authoritative document for the status of the approved configuration of the end items. The latter reflects the history of incorporation of those approved changes into the end items themselves and is the authorative document for the status of the actual configuration of the end items. These reports are just evolving from the rudimentary state and we should see some important progress in this area in the next six months.

This in brief is the Configuration Management Program for Apollo. We consider that Configuration Management methods are important elements of sound business practice. The documentation which is produced through these methods must be accurate and organized, to provide the contractor with valid requirements and the Government with a clear picture of what is produced, and is indeed a prerequisite for prudent decisions. There is nothing revolutionary in this concept and the methods are consistent with those developed by the Air Force over the past eight years. Continuing improvement in the quality of documentation will add much to the effectiveness of Configuration Management on Apollo and future NASA programs.

AMERICAN ORDNANCE ASSOCIATION
ENGINEERING DOCUMENTATION SECTION
CONFIGURATION MANAGEMENT SUB-SECTION ACTIVITIES

A. WAYNE SNODGRASS
MANAGER - MANAGEMENT SYSTEMS
LOCKHEED SHIPBUILDING AND CONSTRUCTION COMPANY

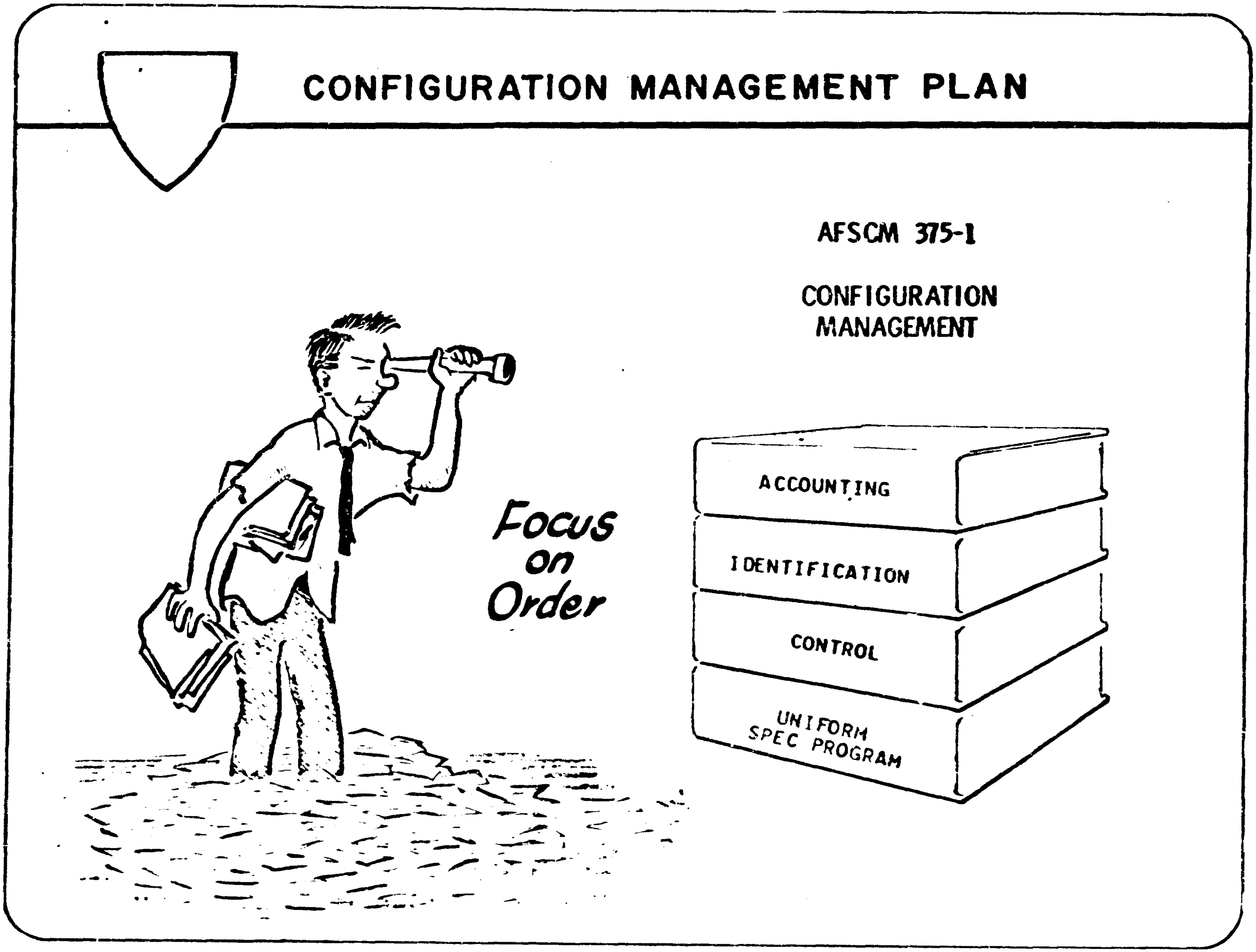
Today's presentation was developed as a report on the status of the American Ordnance Association Configuration Management Sub-Section activities during the past year.


CONFIGURATION MANAGEMENT ORGANIZATION
ENGINEERING DOCUMENTATION SECTION
STEERING COMMITTEE
P. C. WEISSBROD, CHAIRMAN
CONFIGURATION MANAGEMENT
SUB-SECTION
A. W. SNODGRASS, CHAIRMAN
CONFIGURATION IDENTIFICATION
AD HOC PANEL
W. S. TRUMAN, CHAIRMAN
CONFIGURATION CONTROL
AD HOC PANEL
R. LYSYK, CHAIRMAN
CONFIGURATION ACCOUNTING
AD HOC PANEL
G. V. CHARRON, CHAIRMAN

CONFIGURATION MANAGEMENT ORGANIZATION

I would like to take a moment to introduce the AD HOC Panel Chairman. First, the Chairman of the Configuration Identification Panel, Mr. Bill Truman of Goodyear Aerospace Corporation. Next, the Chairman of the Configuration Control Panel, Mr. Ralph Lysyk of Lear Siegler's Power Equipment Division, and finally, the Chairman of the Configuration Accounting Panel, Mr. George Charron of the General Electric Company.

About all we accomplished in our first sub-section meeeting last year was to exchange brief resumes of our experience on the subject of Configuration Management in order to establish a common perspective and develop a plan of operation for our sub-section.


CONFIGURATION MANAGEMENT PLAN
AFSCM 375-1
CONFIGURATION
MANAGEMENT
Focus
on
Order
ACCOUNTING
IDENTIFICATION
CONTROL
UNIFORM
SPEC PROGRAM

CONFIGURATION MANAGEMENT PLAN

We found ourselves sitting there trying to determine how we could focus our activities down to a baseline to work from. We decided to utilize the AFSCM 375-1 document as a basic reference point to tie together our reviews and comments on all the government documents. I want to assure you that we have no intention of limiting our activities to reviewing the Air Force's requirements. We thought it might prove interesting if we also attempted to phase our Sub-section's activities using the Program Phasing techniques now required by DoD Directive 3200.9. We reviewed the DoD program phasing concept, and found that throughout the conceptual phase, contract definition phase, and acquisition phase, there was a very significant requirement for baseline management. It seemed logical to us that we should attempt to manage our activities, utilizing the baseline concept.

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CONFIGURATION MANAGEMENT
SUB-SECTION

CONCEPTUAL PHASE ACTIVITIES

CONCEPTUAL PHASE ACTIVITIES

During the Conceptional Phase of an DoD Systems Program, the relationship of actions are a basic government responsibility. The actions taken during this phase are the creation of a System Program Office or Special Project Office (SPO), the definition of a systems engineering approach, and the preparation of a contract definition plan which includes schedules, funding requirements, end products, program control methods and exceptions to the general rules and regulations defined for the SPO by his higher command. Upon completion of this phase, we have a Program Requirements Baseline defined. This baseline may be considered a contract between higher command and the SPO.

CM SUB-SECTION APPROACH

CONCEPTUAL

AOA
PROGRAM
REQUIREMENTS
BASELINE

RELATIONSHIP OF ACTIONS

- BASIC SUB-SECTION RESPONSIBILITY

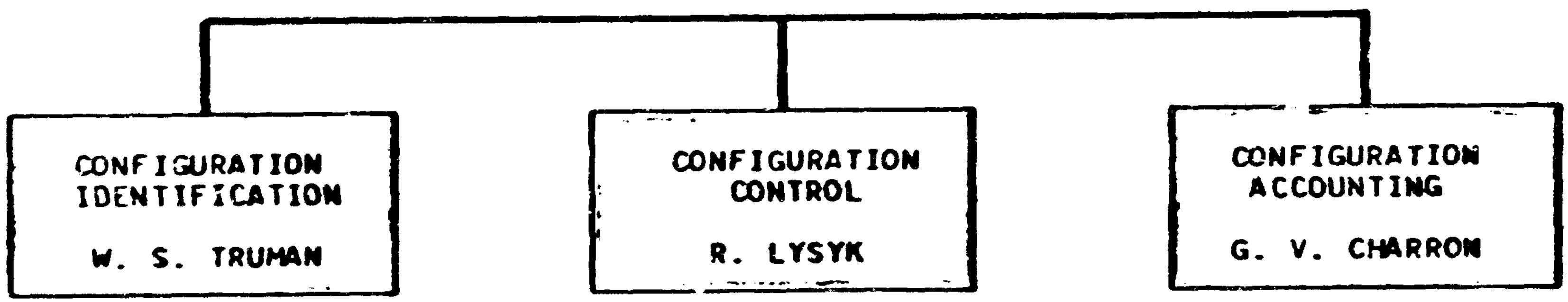
ACTIONS

- CREATE AD HOC PANELS
- DEFINITION PLAN
    - SYNOPSIS OF PURPOSE
    - AD HOC PANEL RESPONSIBILITIES
    - SUB-SECTION INTERFACES
    - OPERATIONAL PLAN
- PROGRAM REQUIREMENTS BASELINE DEFINED
    - BASELINE BETWEEN STEERING COMMITTEE AND SUB-SECTION

CM SUB-SECTION APPROACH

In our Conceptual Phase, the relationship of actions was a basic Sub-section responsibility. We created our AD HOC Panels and defined our synopsis of purpose, panel responsibilities and sub-section interfaces. In addition, we developed an operational plan to establish a baseline between the Steering Committee and our Sub-section. We chose to call this baseline the "AOA Program Requirements Baseline". Let's now review the products of our Conceptual Phase activities.

AD HOC PANEL RESPONSIBILITIES



<u>INDIVIDUAL PANEL CHAIRMEN SHALL:</u>

- DEVELOP DETAILED OBJECTIVES WITHIN SUB-SECTION "SYNOPSIS OF PURPOSE"
- COORDINATE OBJECTIVES WITH OTHER PANEL CHAIRMEN TO ASSURE UNIFORMITY & INTEGRATION

NOTE: SUB-SECTION FOR "PREPARATION & MANAGEMENT OF SPECIFICATIONS" WILL BE REQUESTED TO PARTICIPATE IN CONFIGURATION MANAGEMENT ACTIVITIES

AD HOC PANEL RESPONSIBILITIES

We decided that the individual chairmen should develop their own detailed objectives within the framework of the Sub-section's "Synopsis of Purpose".

We did state, however, that these objectives should be coordinated throughout the various chairmen to assure uniformity and totally integrate our requirements.

By this time, it had become obvious to us that one of the existing Sub-sections of the Engineering Documentation Section should work very closely with our Sub-section. We have asked Mr. Sam Alvine's Preparation and Management of Specifications Sub-section to participate in the Configuration Management activities. There is a tremendous amount of work to be done and we cannot afford duplication of effort.

AD HOC PANEL RESPONSIBILITIES

AFSCM 375-1 (JUNE 1964)

EXHIBIT		DESCRIPTION	1ST PHASE APPLICABLE TO
UNIFORM SPECIFICATION PROGRAM	I	PREPARATION OF THE SYSTEM PERFORMANCE DESIGN REQUIREMENTS GENERAL SPEC	DEFINITION
	II	PREPARATION OF CONTRACT END ITEM DETAIL SPEC (PRIME EQUIPMENT)	DEFINITION
	III	PREPARATION OF CONTRACT END ITEM DETAIL SPEC (FACILITY)	DEFINITION
	IV	PREPARATION OF CONTRACT END ITEM DETAIL SPEC (IDENT ITEM)	DEFINITION
	V	PREPARATION OF CONTRACT END ITEM DETAIL SPEC (REQ'T ITEM)	DEFINITION
	VI	PREPARATION OF DETAIL SPECIFICATION (CRITICAL COMPONENTS)	ACQUISITION
CONFIGURATION CONTROL	VII	SPECIFICATION MAINTENANCE	DEFINITION
	VIII	PREPARATION OF SYSTEM REQUIREMENT CHANGES	DEFINITION
	IX	PREPARATION OF ENGINEERING CHANGE PROPOSALS FOR CEI'S	ACQUISITION
CONFIGURATION IDENTIFICATION	X	STANDARD CONFIGURATION IDENTIFICATION NUMBERS AND NOMENCLATURE	DEFINITION
	XI	IDENTIFICATION & ACCEPTANCE OF EQUIPMENT, FACILITIES, TECHNICAL ORDERS, DATA AND DOCUMENTS	DEFINITION
	XII	ENGINEERING RELEASE RECORD REQUIREMENTS	ACQUISITION
	XIII	REQUIREMENTS FOR VERIFYING THE INCORPORATION OF CLASS I CHANGES	ACQUISITION
	XIV	FORMAL CONFIGURATION MANAGEMENT REVIEWS, INSPECTIONS AND DEMONSTRATIONS	ACQUISITION
CONFIGURATION ACCOUNTING	XV	CONFIGURATION ACCOUNTING DATA ELEMENTS & REPORT REQ'TS	ACQUISITION
	XVI	MANUALLY PREPARED CONFIGURATION MANAGEMENT REPORT REQ'TS	ACQUISITION
	XVII	MACHINE PREPARED CONFIGURATION MANAGEMENT REPORT REQ'TS	ACQUISITION
	XVIII	UTILIZATION AND PREPARATION OF THE AFTO FORM 212	ACQUISITION
	XIX	EXPLANATION OF TERMS	-----

AD HOC PANEL RESPONSIBILITIES (AFSCM 375-1)

As discussed earlier, we chose 375-1 as a base for our review of all the government Configuration Management documents. This chart illustrates the basic division of responsibilities between the various sub-sections and panels. As you can see, the Preparation and Management of Specification Sub-section's activities are a very significant part of the total Configuration Management approach.

We also included the program phasing on this chart to indicate which program phase the individual exhibits or topics apply. Once we had embarked upon the program phasing concept, we thought we wouldn't really be doing the job unless we also defined the "System segments and the program interfaces".

SUB-SECTION INTERFACES

SUB-SECTION	PROPOSED INTERFACE
● ADVANCED METHOD IN TECHNICAL DATA COMMUNICATIONS	INVESTIGATE "CLOSED-LOOP" CONFIGURATION HISTORY DATA BANKS
● CHANGE SYSTEMS FOR ENG DOCUMENTATION	RECOMMEND ELIMINATION OF SUB-SECTION
● DATA LIST MANUALS	COORDINATE CONF MGMT DATA REQUIREMENTS
● DRAFTING EDUCATION ADEQUACY	WILL ASSIST UPON REQUEST
● IMPLEMENTATION OF MIL-D-1000	ESTABLISH MINIMUM MIL-D-1000 CATEGORY, TYPE, & FORM FOR CONFIGURATION MANAGEMENT PROGRAM
● MANAGERIAL AND ADMINISTRATIVE CONTROL OF ENGINEERING DOCUMENTATION	DETAILED INTERFACE REQUIRED WITH AFSCM 375-5 SYSTEM ENGINEERING ACTIVITIES
● MIL-STD-100 ENGINEERING DRAWING PRACTICES	ESTABLISH IDENTIFICATION NUMBERING REQUIREMENTS - COORDINATE WITH AIA POSITION
● NASA ENGINEERING DOCUMENTATION	ASSIST IN ESTABLISHING NASA INTERFACE
● PREPARATION AND MANAGEMENT OF SPECS	DETAILED INTERFACE ON ALL CM ACTIVITIES
● PRICING OF ENGINEERING DOCUMENTATION	IDENTIFY ADDITIONAL COSTS AS A RESULT OF CONFIGURATION MANAGEMENT PROGRAM
● VALUE DOCUMENTATION	CLOSE COORDINATION ON CONFIGURATION IDENTIFICATION AND ACCOUNTING
● VARIETY OF AND UNNECESSARY DATA AND DOCUMENTATION REQUIREMENTS	WILL PROVIDE REVIEW UPON REQUEST
● VENDOR DATA	IDENTIFY IMPACT OF IMPOSING CONFIGURATION MANAGEMENT

NOTE: NO PROPOSED INTERFACE ON REMAINING SUB-SECTIONS

SUB-SECTION INTERFACES

We reviewed each individual Engineering Documentation Sub-section's "Synopsis of Purpose" and proposed these interfaces. We recognized that this integration of activities was beyond the scope of the Configuration Management Sub-section's responsibility, but felt that we should propose the interfaces to the Steering Committee for consideration.

We proposed that Tram Pritchard and his committee on Advanced Methods in Technical Data Communication investigate "closed loop" configuration history data banks in conjunction with its investigation of the latest developments in the field of automated documentation equipment.

After reviewing Ralph Lysyk's Change Systems for Engineering Documentation Sub-section, we proposed that its activities be combined with his Configuration Control Panel. This has been accomplished.

J. Crawford's Data List Manual Sub-section is going to cover the Data Management Manuals such as AFSCM 310-1, we would like to coordinate our configuration management data requirements with Jay's Sub-section.

Kyle Seipp's Drafting Education Adequacy Sub-section; we thought here that perhaps at some point in time, Ken may request our Sub-section to provide him with some familiarization program in support of his activities.

The implementation of MIL-D-1000 Sub-section, chaired by J. Rauth, could assist us by establishing the minimum category, type, and form required to support a Configuration Management Program.

Mr. Christensen's Managerial and Administrative Control of Engineering Documentation Sub-section has been assigned the responsibility of working with systems engineering management requirements such as AFSCM 375-5. One of the end products of 375-5 Systems Engineering process is the specifications required by configuration management. Also, the identification numbering requirements of configuration management are applied on systems engineering documentation. We must work closely together on this one.

The MIL-STD-100 Engineering Drawing Practices Sub-section, chaired by Mr. Christensen, must work very closely with out Sub-section because of the Configuration Identification numbering requirements. We also recommend that this effort be closely coordinated with the recent Aerospace Industries Association position established on Standard Identification numbering. Many of us here, including members of the Steering Committees, participated in that activity.

The NASA Engineering Documentation Sub-section, chaired by Mr. Erben can assist us by establishing interfaces with NASA on the subject of Configuration Management. We would appreciate any connections that Mr. Erben can establish for us, particularly in conjunction with the Apollo Program.

The Preparation and Management of Specifications Sub-section was covered on a previous chart.

The Pricing of Engineering Documentation Sub-section, chaired by Tram Pritchard is being asked to do the impossible. We would like assistance in identifying any additional costs that can be directly charged to a contract as the result of implementation of formal configuration management programs. We do not feel that these costs should include documentation costs such as those already contributed to MIL-D-1000 drawings, specifications prepared under MIL-S-6644, or record requirements for a MIL-Q-9858A Quality Program.

The Value Documentation Sub-section is chaired by Mr. Duffy. There are Configuration Management design reviews and First Article Configuration Inspections that closely relate to his Sub-section's activities; we would like to be coordinated on these subjects.

The Variety of and Unnecessary Data and Documentation Requirements Sub-section, chaired by Mr. Ramsey might, as some point in time, ask us to comment on the configuration management requirements in his area.

Finally, the Vendor Data Sub-section, chaired by Mr. Symanoskie, could assist us by defining the impact caused by imposing prime contract configuration management requirements on the sub-contractor/vendors.

In summary, perhaps our interface recommendations may seem too ambitious, but in order to insure consistent interpretations we think that we must be closely integrated in all of our related Engineering Documentation Section activities.

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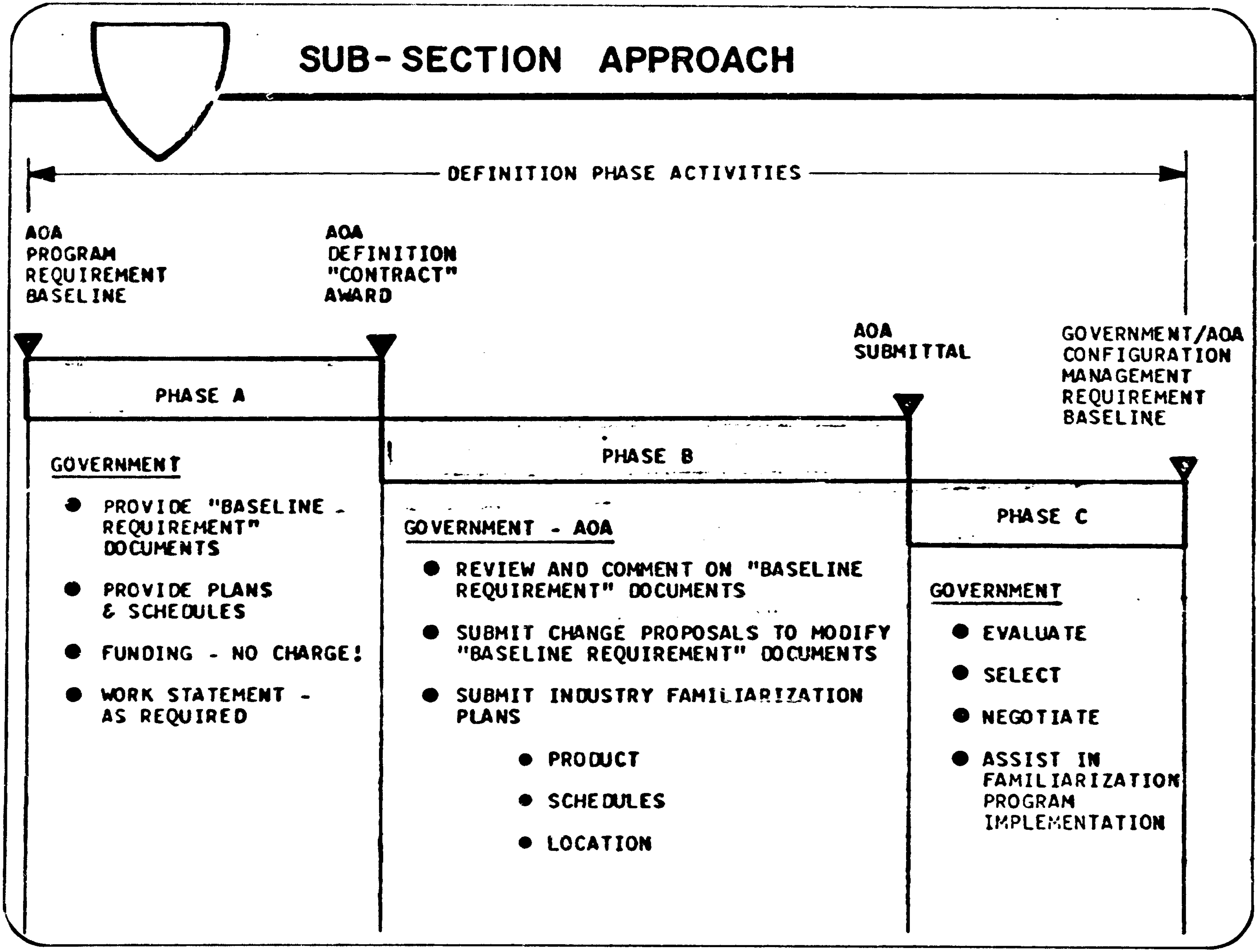
CONFIGURATION MANAGEMENT
SUB-SECTION

OPERATIONAL PLAN
FOR
DEFINITION PHASE ACTIVITIES

OPERATIONAL PLAN FOR DEFINITION PHASE ACTIVITIES

Let's review our progress thus far; we created our AD HOC Panels, we have a synopsis of purpose, the AD HOC Panel responsibilities are being developed by the respective chairman, we have established our sub-section interfaces, and we will now discuss our operational plan. We have obtained the AOA Steering Committee's concurrence, and therefore have established an AOA Program Requirements Baseline from which point we can proceed to accomplish our objectives.


SUB-SECTION APPROACH
DEFINITION PHASE ACTIVITIES
AOA PROGRAM REQUIREMENT BASELINE
AOA DEFINITION "CONTRACT" AWARD
AOA SUBMITTAL
GOVERNMENT/AOA CONFIGURATION MANAGEMENT REQUIREMENT BASELINE
PHASE A
GOVERNMENT
PROVIDE "BASELINE - REQUIREMENT" DOCUMENTS
PROVIDE PLANS & SCHEDULES
FUNDING - NO CHARGE!
WORK STATEMENT - AS REQUIRED
PHASE B
GOVERNMENT - AOA
REVIEW AND COMMENT ON "BASELINE REQUIREMENT" DOCUMENTS
SUBMIT CHANGE PROPOSALS TO MODIFY "BASELINE REQUIREMENT" DOCUMENTS
SUBMIT INDUSTRY FAMILIARIZATION PLANS
PRODUCT
SCHEDULES
LOCATION
PHASE C
GOVERNMENT
EVALUATE
SELECT
NEGOTIATE
ASSIST IN FAMILIARIZATION PROGRAM IMPLEMENTATION

SUB-SECTION APPROACH

DoD Contract Definition activities are subdivided into three phases; Phase A, Phase B, and Phase C.

During Phase A, the government is responsible for preparing the definition package that describes the Program Requirement Baseline for the competing contractors to expand into a Design Requirements Baseline.

During Phase B, the contractors, with assistance from the government, develop program management plans, propose necessary changes to the Program Requirements Baseline, write the required specifications and submit them along with their Acquisition Phase plans to the government.

During Phase C, the government evaluates the contractor's definition phase products, selects the winning contractor and negotiates an Acquisition Phase contract which establishes the Design Requirements Baseline.

During our Phase "A", we propose that the government agencies responsible for Configuration Management objectives and implementation provide us with their latest directives and documentation on the subject of Configuration Management. In addition, we need to become familiar with their implementation plans and schedules. We expect no funding for our services. The only "Work Statement" required is a letter outlining the particular government agencies needs.

During Phase B, based upon the time span allotted by the Government, we will review and comment objectively on the documentation and directives. Changes will only be proposed when they facilitate interpretation or industry implementation procedures without compromising the government's basic objectives. In addition, we will attempt to provide plans for industry familiarization programs in association with our AOA activities. In our review of the various government Configuration Management documents, we do not intend to perform a "proof reading service" for the government. We shall strive for standardization and uniformity of basic objectives and implementation requirements. We intend to make recommendations that will strengthen the compatibility of the DoD requirements and industry operating procedures.

We also intend to be very careful and not duplicate the effort of other technical committees and industrial associations. For example, we intend to keep closely tied in with the Aerospace Industries Association (AIA). I personally worked on the preparation of the AIA Identification Numbering position which has been presented to various members of government agencies, including Mr. Roach, General Stanwix-Hay, and representatives of NASA. In addition, George Charron has been active as a member of the Defense Industry Advisory Council's activities on Configuration Management.

During Phase C, the government will be requested to evaluate our efforts, select change proposals for incorporation and negotiate remaining areas of interpretation conflict, if any exist. Finally, we request that the government assist us in the finalization and implementation of our AOA Configuration Management familiarization program.

The attendance of these very capable government panel representatives here at our meeting today was a direct result of an invitation extended by our Sub-section. We sincerely hope that this is only the first of many interchanges of information on the subject of Configuration Management. We would like to obtain assistance from responsible representatives in the preparation of familiarization and training programs to be presented to industry representatives at our annual meeting and other special occasions. We think that this is a very important means of communication available to the government. The presentations provide the government an opportunity to communicate its requirements to industry's representatives.

AMERICAN
ORDNANCE
ASSOCIATION

CONFIGURATION MANAGEMENT
SUB-SECTION

OPERATIONAL PLAN
FOR
ACQUISITION PHASE ACTIVITIES

OPERATIONAL PLAN FOR ACQUISITION PHASE ACTIVITIES

Now that we have presented our Conceptual Phase activities and our Definition Phase Plan, all that remains is our planning for the Acquisition Phase.

AOA CONFIGURATION MANAGEMENT SUB-SECTION

We decided that it was much too early for us to consider activities beyond our "Definition Phase". Detail planning too early in a program stifles creativity and restricts flexibility in adopting to changes in the state-of-the-art.

For now, we only want to assure you that when a requirement for our services is made known, we will strive to accomplish the request.

In closing, I would like to quote from a document prepared for the Office of the Secretary of Defense, Director of Defense Research and Engineering, by Peat Marwicks Management Systems Corporation. The document is titled "Lessons Learned from Contract Definition", and is dated August 16, 1965. The quote is as follows:

"When government guidance is too vague and general, the contractors often have over-responded in order to include everything that they feel the government might want. As a result, the proposals have become excessively long and difficult to evaluate --- The government project team, however, is in a position to lead a contractor to victory or defeat, so extreme care must be taken to ensure fairness. The government team should not suggest specific technical approaches, since by so doing, the creativity of the contractors will be restricted and the potential benefits of Contract Definition reduced. With the proper balance, collaboration between the government and the contractors will result in a better overall program plan and the best contract document for development."

AOA CONFIGURATION MANAGEMENT SUB-SECTION

FUTURE ACTIVITIES:

AOA EXISTS SOLELY FOR THE ADVANCEMENT OF ADEQUATE NATIONAL DEFENSE FOR THE U.S. IN THE FIELDS OF:

- WEAPONS TECHNOLOGY
- PRODUCTION
- LOGISTICS

A HARD LOOK AT SOFTWARE

By: Don W. Dunn
Apollo Data Manager
Manned Space Flight
NASA

Mr. Dunn, a senior civil servant with extensive experience in government service, was first associated with data management in 1942, as an Army Adjutant General. During the war years, he advanced through administrative levels of the Army, ending as an airborne division Adjutant General. Much of the material covered in the Apollo Data Management presentation comes from experience gained in developing data requirements for management control systems in the Army, Air Force Research and Development Command, Airways Modernization Board, Federal Aviation Agency's Research and Development Service, and Office of Manned Space Flight of the National Aeronautics and Space Administration.

Included among honors he has received from the Federal Government is the United States Air Force Meritorious Civilian Service Award.

There is a time, in any effort producing an end product, when you stop occasionally to evaluate your activity and what you are trying to do. At Apollo, however, we have found that an occasional look-see is far from sufficient. Our hard-look-at-software moments occur every minute of every day. Every plan devised, every change initiated, every action taken, everything we do from the data management angle must be considered in its effect on our end product, the reports, drawings, specifications, schedules, manuals -- you name it -- that we call data.

Does it improve the system? Does it assist our operations? Does it make our data better, easier to use? Does it save money? And, if it does save money, does it do this without reducing the quality of our end product?

These questions must be answered for everything we do, and answered correctly.

We have to manage our software with the same care and detail that both industry and government have used in developing, producing, and using hardware. We must assure that the data - the software - the end product of data management is clearly defined, adequately justified, promptly procured, intelligently distributed, and removed from the system when it is no longer of Apollo value. And, all this must be done with dollar-economy in mind.

To do this managing job effectively and economically, we need to know the size of the data management problem, what it has cost in the past, and how the price we pay for it can be reduced in the future. We need to understand the organisations established for our purposes, the tools employed in our work, and the procedures we follow.

These items I intend to discuss today, but first, we must define data itself. Unfortunately, even about so simple a word as 'data' we find considerable disagreement. So much, in fact, that one might say there are as many definitions of data as there are people defining it. At Apollo, we merely say that data is: INFORMATION IN AN ORGANIZED PHYSICAL FORM REQUIRED TO MANAGE THE APOLLO PROGRAM.

B8

Many in industry and government, of course, look on data as particularly technical information, but in Apollo we have found it necessary to broaden this thought to take in all types of information, including technical and managerial. Our position is that there are two management systems working -- one of these concerns Configuration Identification and Accounting, and the other, of course, Data Management. Hardware is controlled through Configuration Identification and Accounting -- software is controlled through the Data Management system. It's that simple. The fringe area items, such as tapes, that would seem to possess both hardware and software characteristics we classify by answering a simple question -- does the item under consideration cost a significant amount of money? If it does, it's controlled under one or the other system.

The amount of this software employed in the Apollo Program is tremendous. We estimated a couple of years ago that there were 18- to 40-thousand different line items of data in the Program, generating two- to four-million copies within a given year. These line items, you must remember, vary from a single copy, one-time report to Failure Reports that can run into thousands of separate documents.

In the Apollo Program, according to our current census, 220,546 copies of one-time reports are constantly going through the system. On a yearly basis, this reached about 1.3-million copies. We are not yet to the point of analyzing every line item of data being generated in the Apollo Program, but our current estimate is that we are about 70 percent through the process of surveying each line item, putting it into the system, or retiring it.

Having taken a look at the size of Apollo data, let's now consider the cost of it.

Actual experience on major government research and development programs indicates that 10 to 22 percent of the research and development dollars may be involved in the acquiring of data. This assumes, of course, that a formal system of data management is in operation. Where no such system exists, estimates of data costs in research and development programs have been as high as 40 percent of the total program outlay.

If we apply these 10, 22, and 40 percent figures to the principal contractors in the Apollo Program, we can even more readily see the effect of data management on program costs.

Considering our present funding level, $4.5 billion, at the 40 percent estimate where no formal data management system exists, we could be spending up to $1.7 billion in acquiring data. If we use the 22 percent figure, which results when data is monitored through an itemized listing, data costs are a little less than one billion dollars.

But at ten percent, when a formal data management system such as ours is fully operational with its processes of review and analysis to eliminate non-essential or duplicate reporting requirements, Apollo data costs are slightly less than a half billion dollars.

What does this prove? -- Only this -- every dollar we can save on data costs is another dollar made available for hardware. In fact, a one percent reduction in Apollo data costs could mean as much as 50-million dollars additional made available for the ultimate end product -- hardware.

For this, it is easy to understand that a great deal of our effort and thought have been expended with dollar-economy in mind. Later, I will point out to you some of the specific actions we have taken in this regard.

Now that we have the size and financial impact of data on the Apollo Program, let's take a look at our organization to meet the demands of the task before us.

It is well known that the government, from the White House down, has become quite interested in Data Management. An Industry Advisory Council on federal reports has been established. Also a Commission on Science and Technology was recommended to the 88th Congress by then-senator Humphries. Although this bill was not made into law, an identical bill has been introduced in the 89th Congress, indicating the fact that our top leaders appreciate the need for tighter control of documentation.

At Apollo, everybody is concerned with data management, directly or indirectly. The people directly concerned include the Apollo Program Director, who establishes all Apollo Program Office policies, including data management. He also approves all data requirements for APO and selects experts for the Ad Hoc Data Review Teams. The Apollo Data Manager administers the Apollo Data Management System within APO and monitors functioning of the Center Systems. He is the in-house expert on the System.

In each of our Apollo Program Office sections, or directorates, a Directorate Data Manager is functioning. They advise, review, coordinate, and insure that the total data management requirements within a Directorate are consistent with their assigned task.

Apollo Ad Hoc Data Review Teams review data requirements and assist the Program Director in determining whether data requirements are sufficient and needed. The team also evaluates the estimated cost of data and its potential value to the Apollo Program.

Respondents prepare data authorized for acquisition. They also provide estimated costs for preparation of data and make recommendation concerning better ways of satisfying data requirements. The respondent may be a contractor, a NASA MSF Apollo Center, an office within APO or NASA, or some other government agency.

A special feature of the Apollo Data Management System involves the use of Offices of Primary Responsibility (OPR), the keystone of the entire System. The OPR may be one man or a group of men who initiate the data requirement, justify it within the Apollo Program, acquire the data, and control it after it is produced.

Of special interest to the OPR, although certainly used by all APO Data Management people, are several critical reference documents. These are:
The Apollo Program Development Plan, section 4 of which states general data management policy.

NPC 500-6 The Apollo Documentation Administration Instruction, which discusses General Data Management Procedures For The Program.

The APO Implementing Instruction 2200.1, describes the forms and procedures, the data management tools, to be used at APO and, in addition, lists the duties of all APO personnel concerned with managing data.

The organization of APO for data management is quite similar to that of the Department of Defense. In fact, Apollo has made every possible effort to standardize with DOD procedures and forms, so that a contractor will be able to respond to a NASA Apollo requirement just as he does to a DOD data requirement. In Apollo, we control in-house generated data in the same way and under the same regulations as contractor-generated data. This includes management as well as technical data. To put it another way, our system is devised on a do-as-we-do pattern. If a contractor is required to respond in a certain way or use a specified form in his response, the same requirement is placed on our own organizations in supplying in-house prepared data.

The tools of Apollo data management are, in general, not unique to the Apollo System. In pursuit of the standardization mentioned above, we have adapted several forms from other governmental agencies for Apollo use. The tools are designed to accomplish the data management objectives of timely and accurate data, presented in the most usable form. Additionally, they provide a pattern or process by which we can assure that data requests are defined, justified, acquired, distributed, and controlled. The data management tools I will discuss in detail are:

The Document Requirement Description (DRD), the definition tool.

The Document Requirement Justification (DRJ), which assures that the data it concerns is really an Apollo need.

The Data Requirement List (DRL), the acquisition tool.

The Apollo Document Distribution List (ADL), which provides distribution guidance within the APO.

The Request for Apollo Documents (RAD), to be used in requesting copies of previously published documents.

The Apollo Document Index (ADI), which catalogs documents published or scheduled to be published.

The Document Requirements Description (DRD), NASA Form 1107, is basically the same as the Air Force Form 9. It defines the Data requirement in detail. We are presently developing a set of instructions or checklist to assist both APO personnel in completing the form and our contractors in responding to it.

The Document Requirement Justification (DRJ) is strictly an in-house requirement. It is quite similar to a form the Bureau of the Budget has used for many years. It presents a considerable listing of questions to be answered by the person requiring the data. It also is of use to the approving office in determining whether the data requested is really needed.

The Data Requirements List (DRL) is about the same as the DOD Form 1423. It is our 'shopping list' and provides not only an opportunity for the respondent, (the contractor or APO Directorate preparing the data) to establish an initial estimate of the cost of the data, but also serves as a contractual instrument for the development of the data.

The Apollo Document Distribution List (ADL) is another in-house form. It provides the OPR's estimate of who in the Apollo Program should receive a data item, and, after coordination, becomes the listing on which initial distribution is based.

The Request for Apollo Document (RAD) is an order blank to be used by an individual or staff element in requesting data already published and distributed.

The Apollo Document Index (ADI) serves many purposes. Essentially, it is a catalog of documents published or approved for publication. It is organized in accordance with the 18 managerial functions described in the Apollo Program Development Plan and supports that key management document.

In the sense that these Data Management tools assure that only the minimum of essential data is acquired, and that distribution of this costly data is regorously controlled, the tools not only put the right data in the right hands at the right time, but they are also highly prized money-savers.

There are many other areas, peripheral to the main issue of acquiring, distributing, and controlling data, where savings can be made. To these areas we have devoted a considerable Data Product Analysis effort. The pay-off here is much larger than you might think.

But, before we can do any really effective data value engineering, we must know just how much money data is costing us. This is far more difficult to determine than it would appear on the surface. Not only does every organization that bothers to measure this factor use its own criteria, but many industrial firms are understandably reluctant to release their figures.

As a starting point, we have taken our own experience, and any other information on data-dollar-costing we could find, and listed these costs against various types of data. From these we have developed a device that presents what information we have and, hopefully, will enable others to come to our assistance. It is a do-it-yourself slide rule. If you don't like our costs, there are spaces on the slide for you to enter your own. In addition, with the slide rule, we provide an extra insert on which we hope interested parties will enter their figures and return the extra insert to us. We will put this information into our data bank and come out with a new and more authoritative slide rule this summer. The current issue, of course, contains only our estimates of data costs.

Once we begin to know what data actually cost, we hope that new avenues for dollar-savings will appear. At the least, we will know a great deal more about where our data-buying dollar is going.

These, of course, are not our only problems. Over-packaging and overly expensive shipping methods, for example, may seem small in terms of the overall cost of Apollo. But, consider the way we receive documents in the Apollo Program Office, surrounded by expensive cushioning material, wrapped in moisture-proof paper. We think that by using commercial packaging practices, we could save up to 70 percent of our document packaging costs.

The use of unnecessarily expensive shipping methods is just as ever-present as over-packaging. We had our mail room checked for a ten day period and found that every package of documents coming in to the Apollo Program Office was arriving by Air Mail, Special Delivery. So, we called this to the attention of our contractors and asked them to discontinue it. The worst of it was that we discovered our own people were following the same practice -- we have the problem of educating our contractors and our own shipping personnel at the same time!

Although shipping costs may sound small and unimportant, consider this -- we are talking about shipments that cost an average of between fifty and a hundred dollars. In some cases, armed surveillance has been used, running up the price of the mailing even higher! Associate these costs with the million-plus documents moving around in the program, and the problem becomes far greater in dollar importance.

To correct such difficulties as these, we needed standards. To our surprise, no standard for packaging and shipping ordinary documents was available. There were standards for packaging and shipping almost anything else from delicate laboratory equipment to automobiles, but nothing on documents other than drawings. So, we prepared our own. This standard, along with other standards on how to prepare the documents we call Data Management tools, is published in our Apollo Document Preparations Standards Handbook, NHB 2314.1.

As an example of areas where savings are possible, let's take a look at document binders. Some of the binders we have used have cost as much as $495.00 per hundred, while others have cost as little as $155.00 for the same number. If a $4.95 binder is necessary for a certain document, it should be used -- but, if a $1.55 binder will satisfactorily do the job, then certainly the difference should be saved and added to the amount of data savings made available for hardware-purchase. And this comment is not necessarily pointed solely at contractors. If we can apply such savings policies to contractors, then we must also in honesty apply them to ourselves.

Document size is also an area where money-savings are possible. In NASA Apollo, we have found two major advantages to the use of 'paperback' sizes. First, it's cheaper. Printing and publication costs can be cut as much as 66 percent by appropriate document size reduction. Secondly, its more convenient. It can be carried along in a pocket for reading at your convenience.

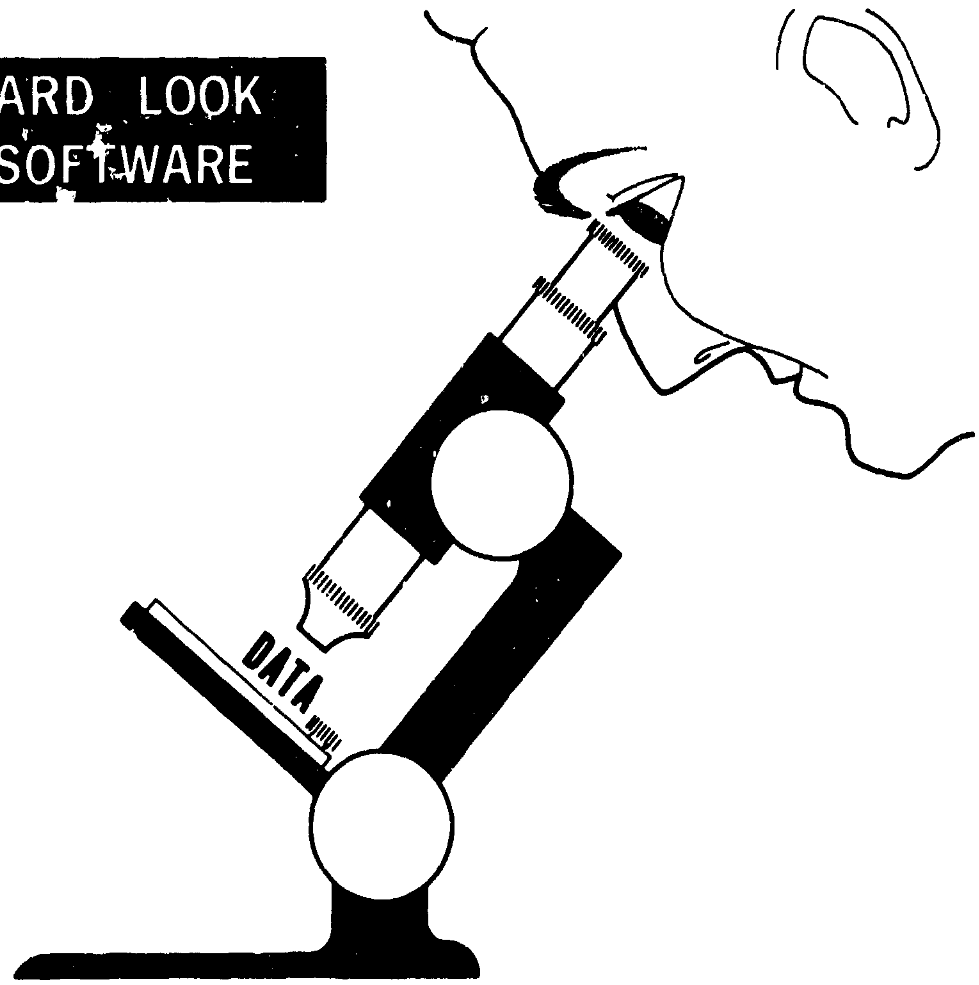
In addition to all these actions aimed at minimizing document packaging and shipping costs, we have developed an over-packaging, expensive-shipping label. We have issued these labels to our receiving clerks, telling them, "When you receive a package that looks as though it has been over-protected, or shipped by an unnecessarily expensive method, stick one of these labels on the document receipt".

Now we have the shipping clerks working with us on reducing packaging and shipping costs. The next step is to get the top management people into the act. For them we have devised a 'DISCONTINUE DISTRIBUTION' label. To these people we have said, "When you receive a document you don't want, stick this label to it and send it back. We'll take your name off the distribution list".

So, the system is working. We have our packaging and shipping standards, we have the men on both ends of the system working with us. And, the costs of packaging and shipping are coming down. But there is one big pool of brainpower and experience we have not yet tapped. What about contractors? There is no doubt they often receive data requirements they know are unessential, too complex, redundant, untimely, or will cost more than they are worth.

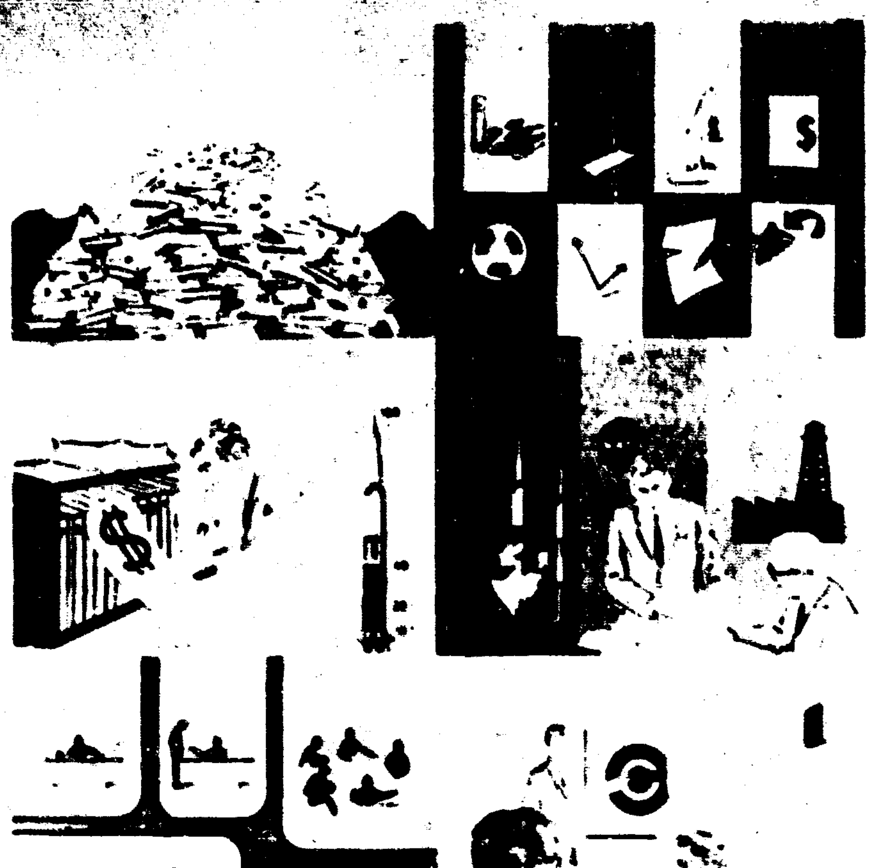
We are now exploring means and methods for bringing the contractor more intimately into the picture. Perhaps we need a label for them to use, a label to permit them to express their knowledge and experience to Apollo advantage. Letters, memo's, and telephone calls help, of course, but what we need is a faster, more informal, more convenient method. We are wide open to suggestions.

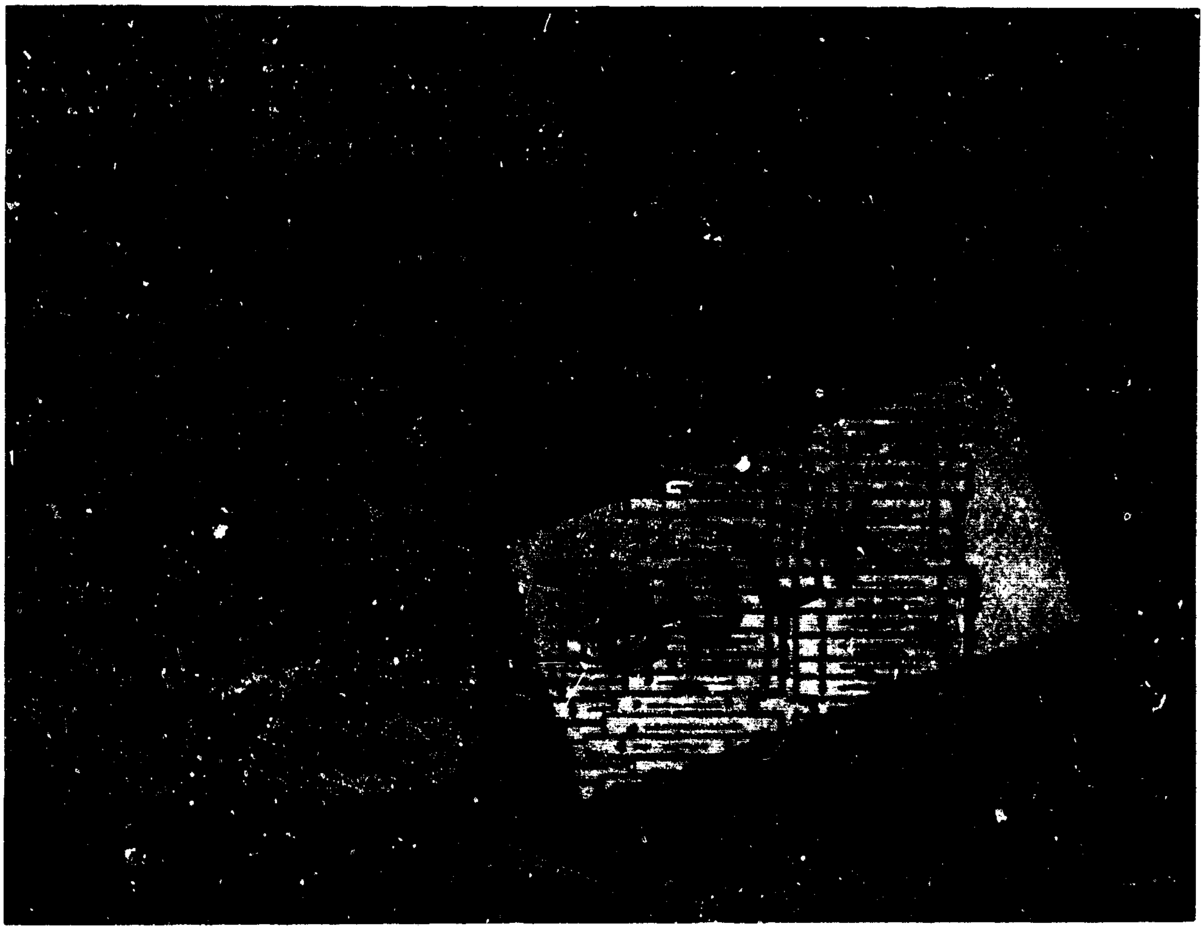
A HARD LOOK
AT SOFTWARE

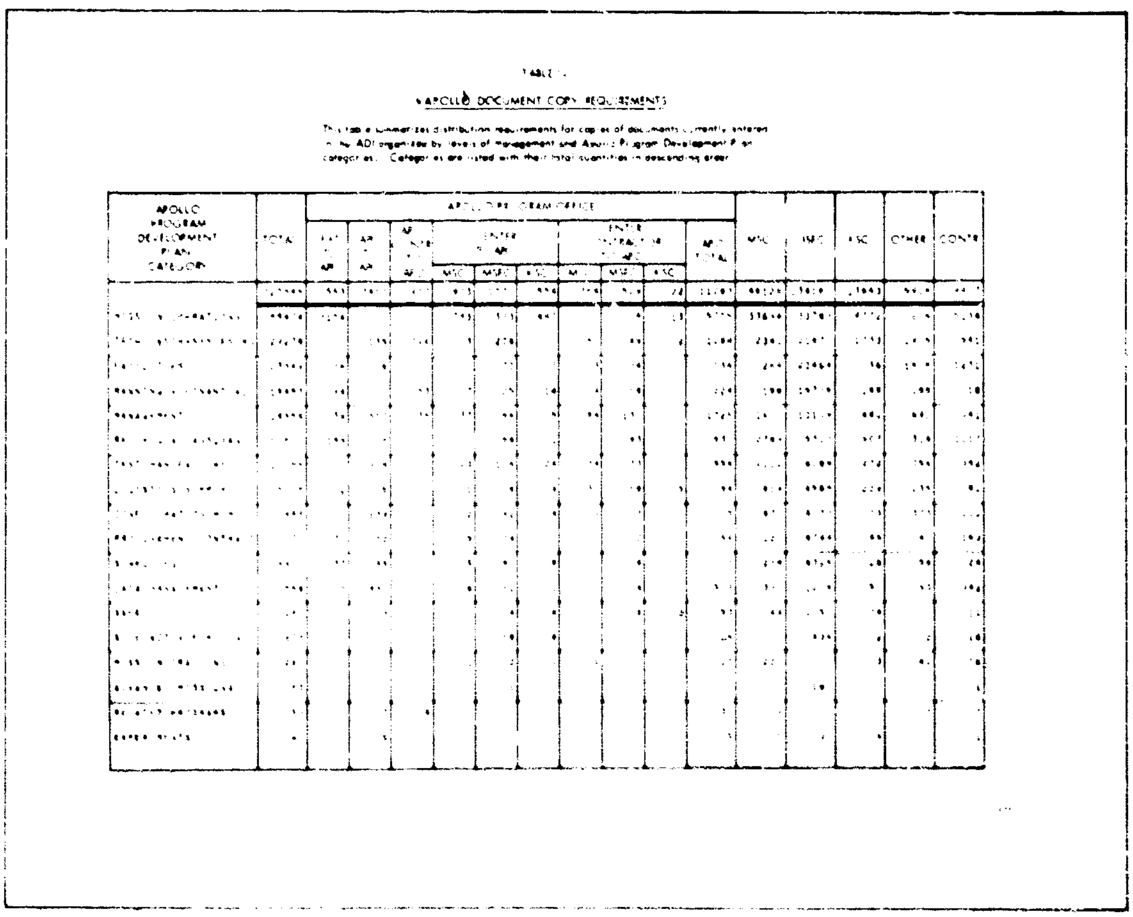


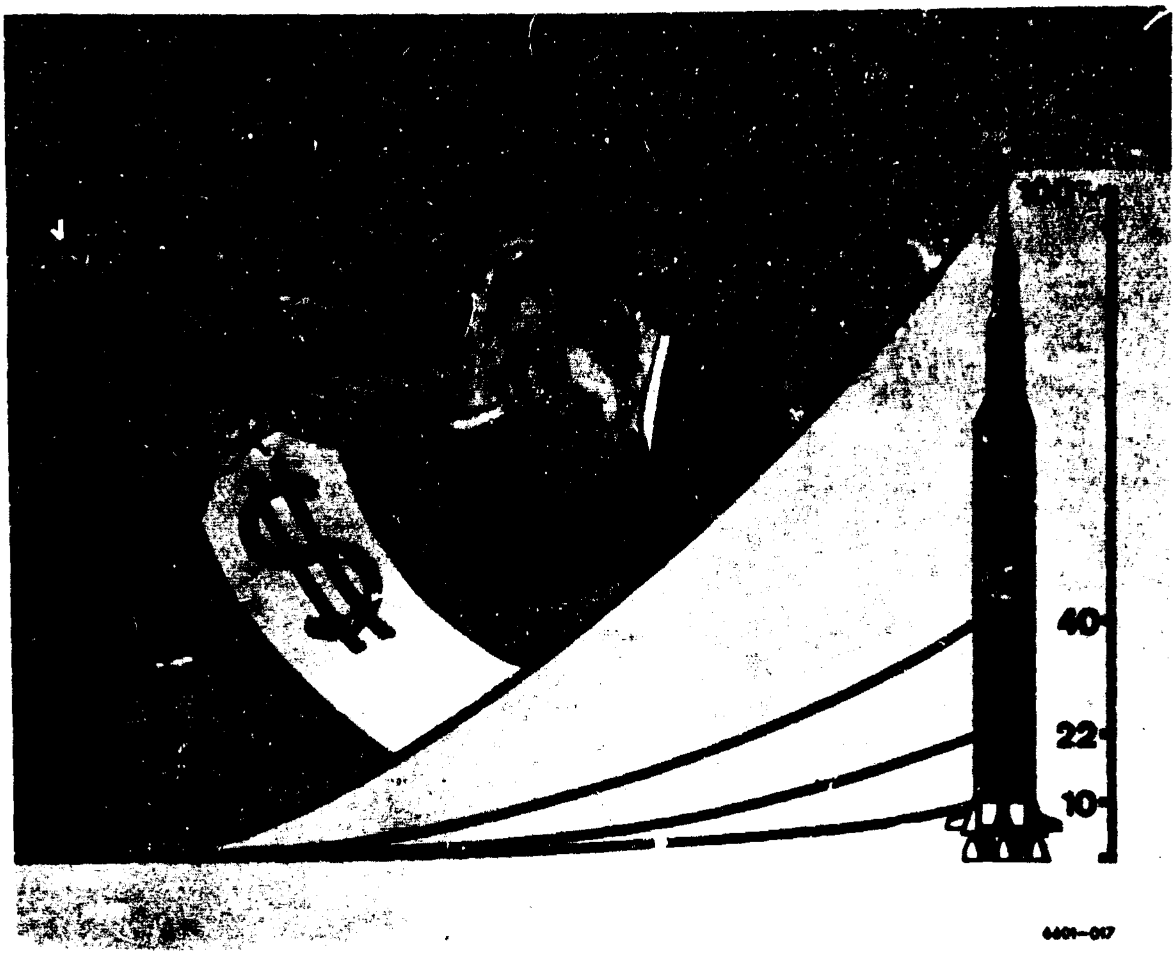
DATA

"INFORMATION IN AN ORGANIZED PHYSICAL FORM REQUIRED TO MANAGE THE APOLLO PROGRAM"






APOLLO DOCUMENT COPY REQUIREMENTS
TOTAL
MSC
OTHER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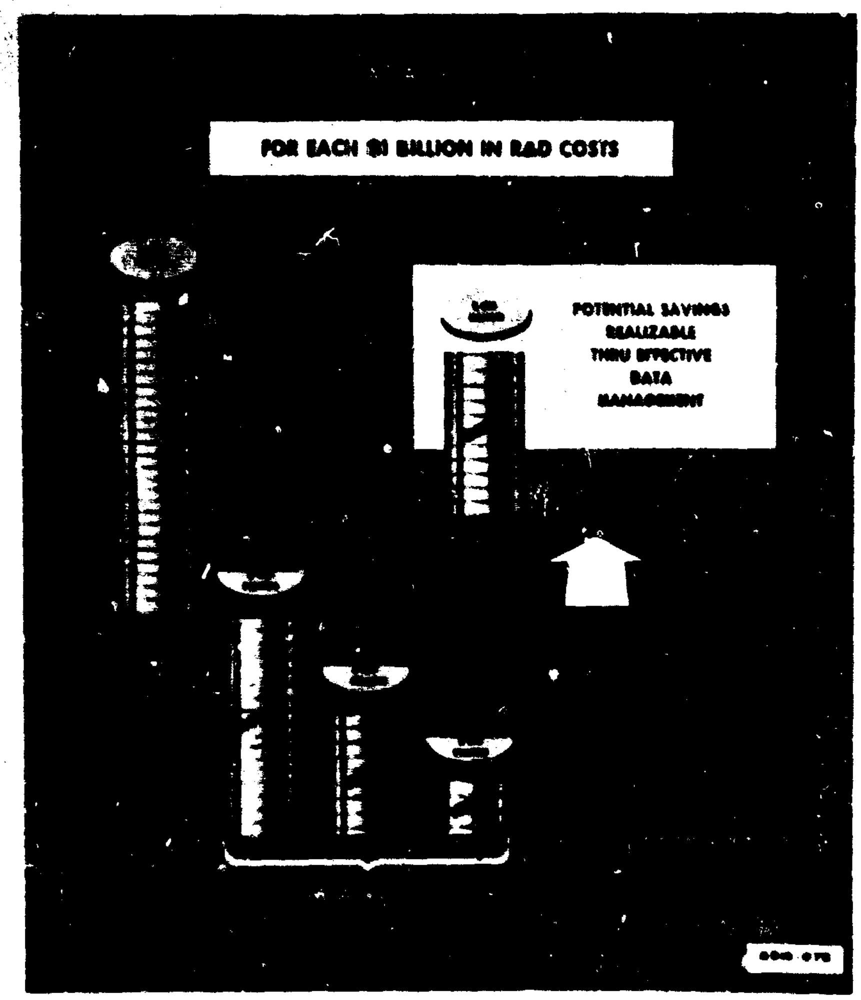
6601-017

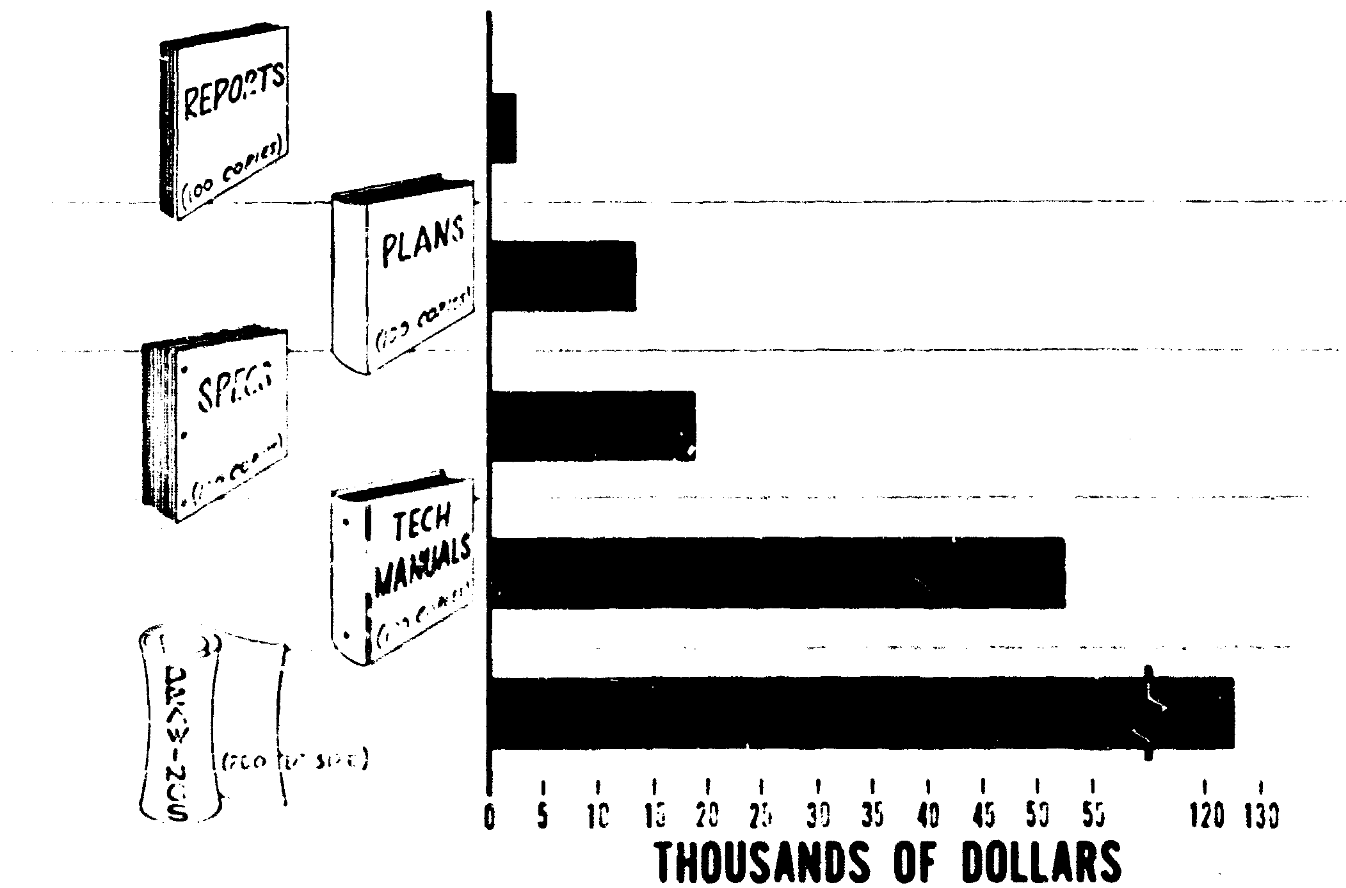

FOR EACH $1 BILLION IN R&D COSTS
POTENTIAL SAVINGS
REALIZABLE
THRU EFFECTIVE
DATA
MANAGEMENT

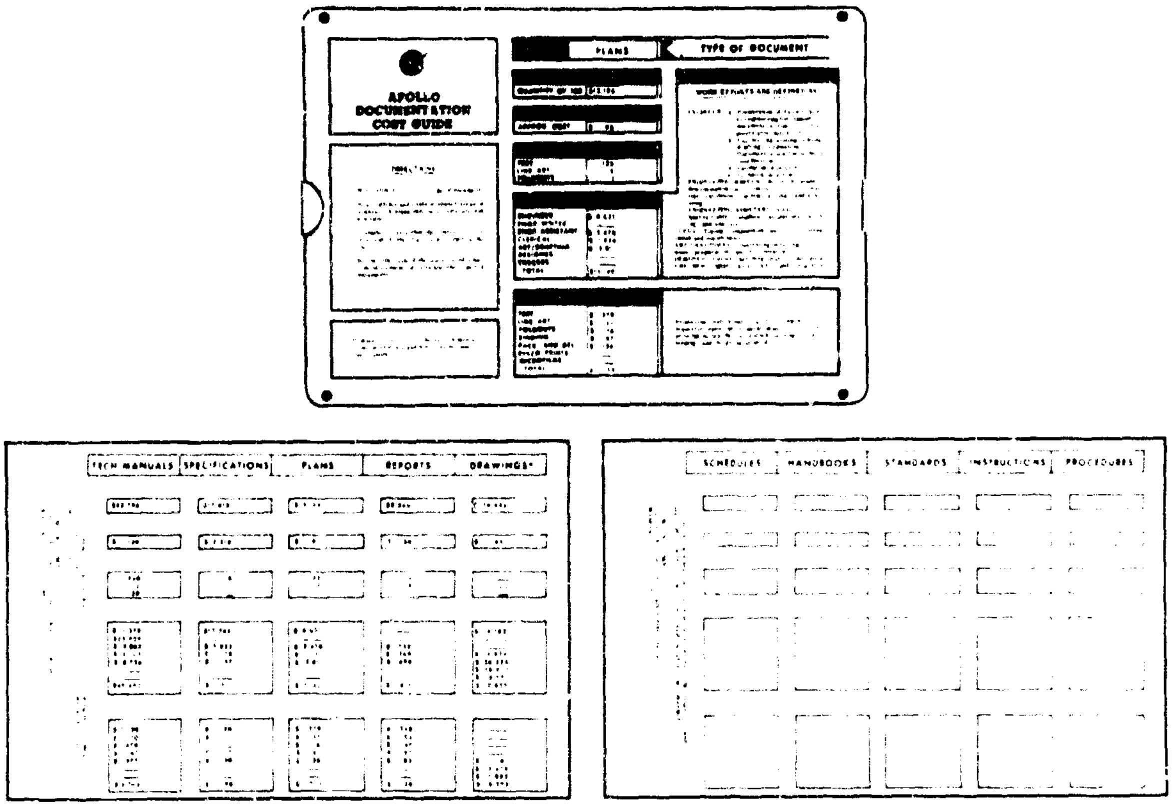
R & D DATA COSTS

CONTRACTOR	ORIGINAL ESTIMATE	NEGOTIATED COST (APPROXIMATE)
HUGHES AIRCRAFT CO. (HAC)	$3,116,321	$3,570,000
GOODYEAR AIRCRAFT CO. (GAC)	1,507,064	510,000
THIOKOL CHEM. CO. (TCC)	5,363,739	470,000
MARTIN-MARIETTA CORP. (MMC)	2,312,869	600,000
AERONUTRONIC DIV. FORD (ADF)	2,591,357	420,000
GENERAL PRECISION, INC. (GPI)	7,701,707	4,300,000
BECHTEL CORP. (BECHTEL)	14,570	50,000
	$22,607,627	$9,920,000
	22%	10%

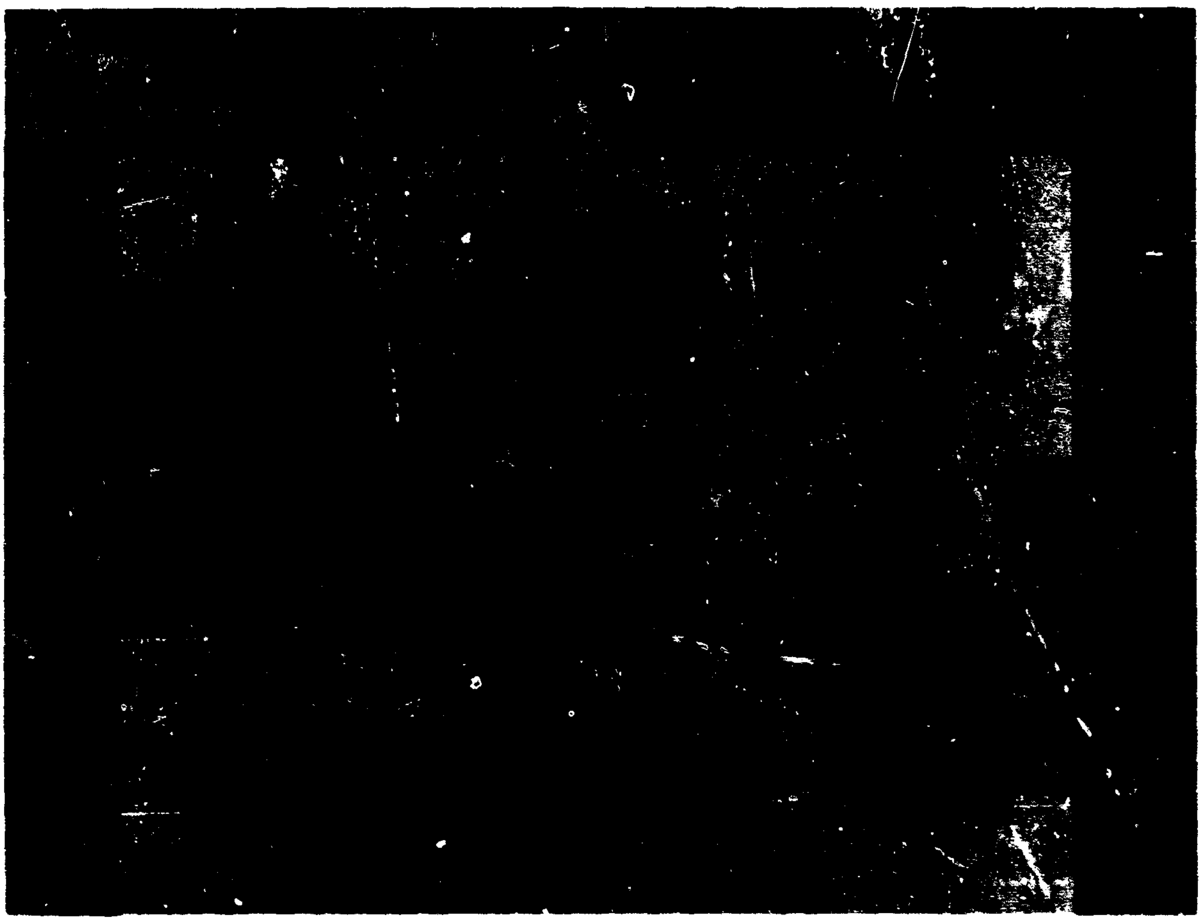
TOTAL COST

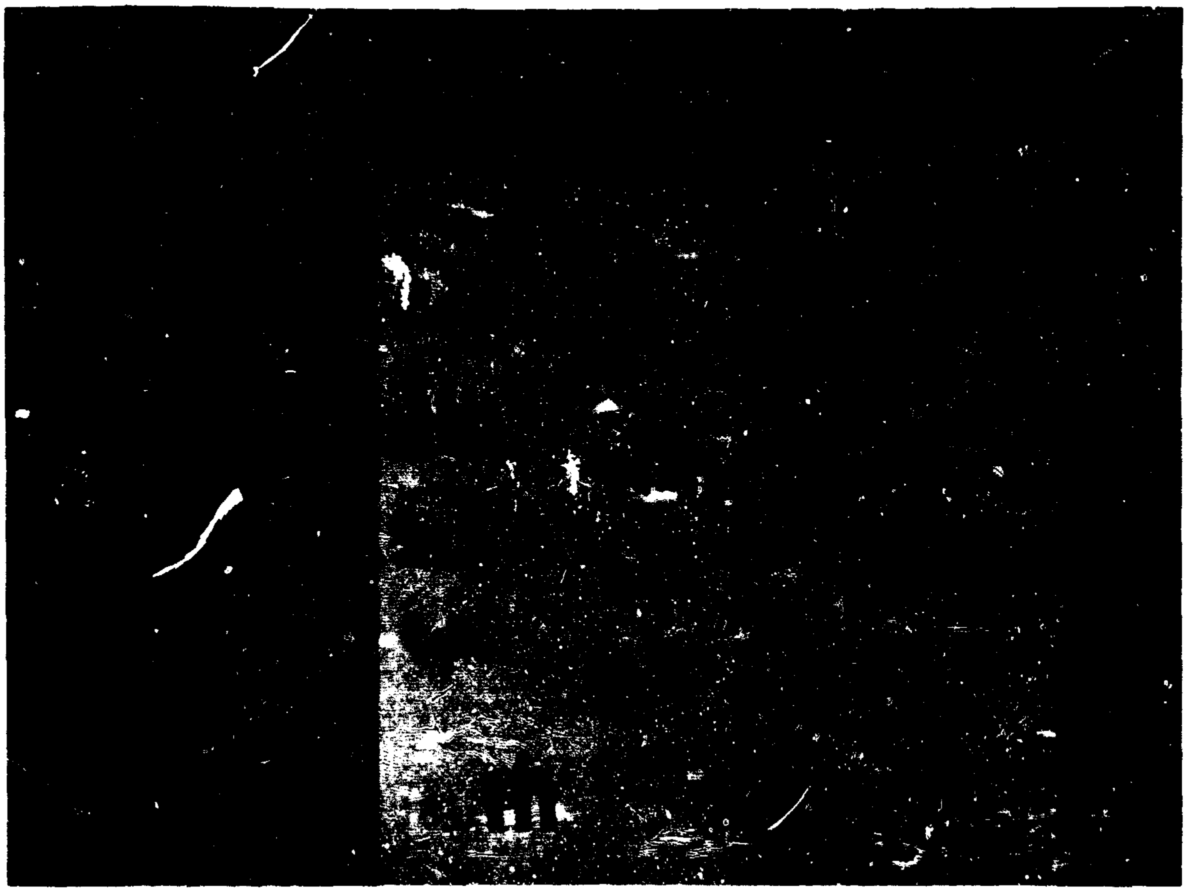
APPROXIMATE COSTS OF TYPICAL DATA ITEMS

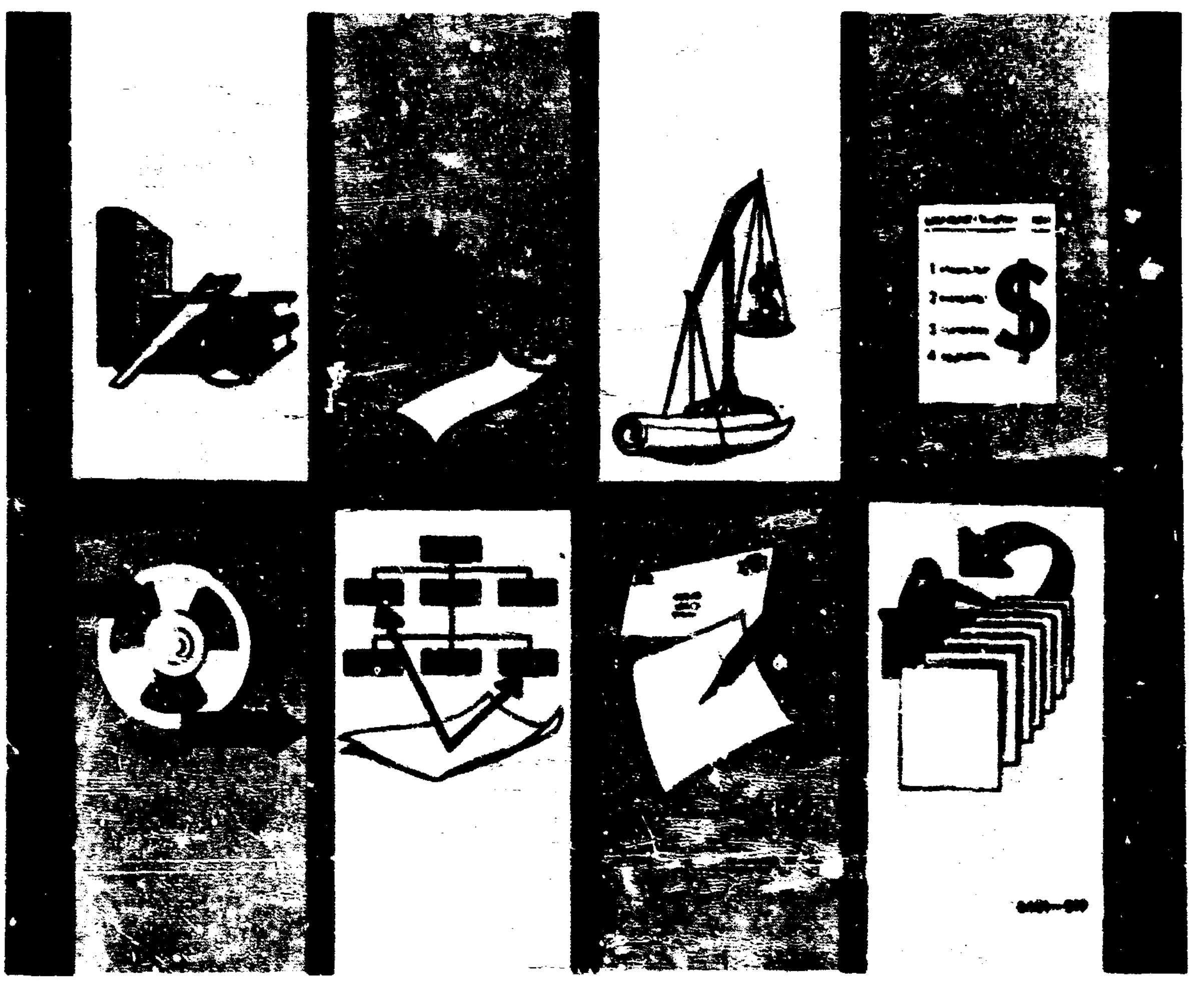



APOLLO DOCUMENTATION COST GUIDE
PLANS
TYPE OF DOCUMENT
TECH MANUALS
SPECIFICATIONS
PLANS
REPORTS
DRAWINGS*
SCHEDULES
HANDBOOKS
STANDARDS
INSTRUCTIONS
PROCEDURES

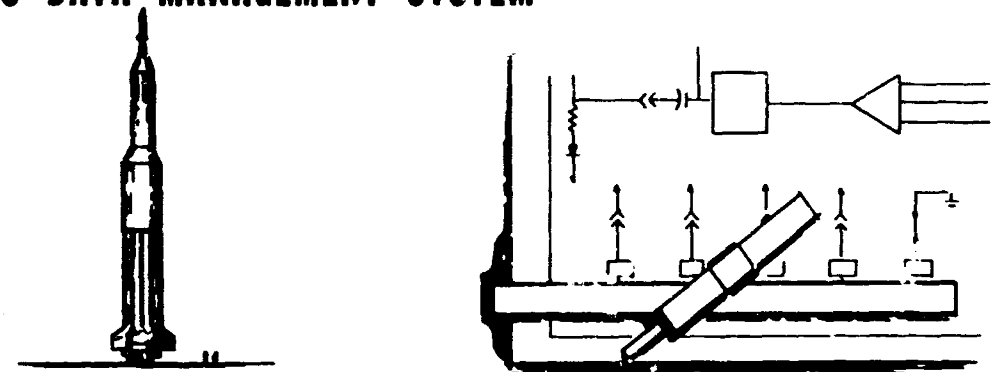
6509-041







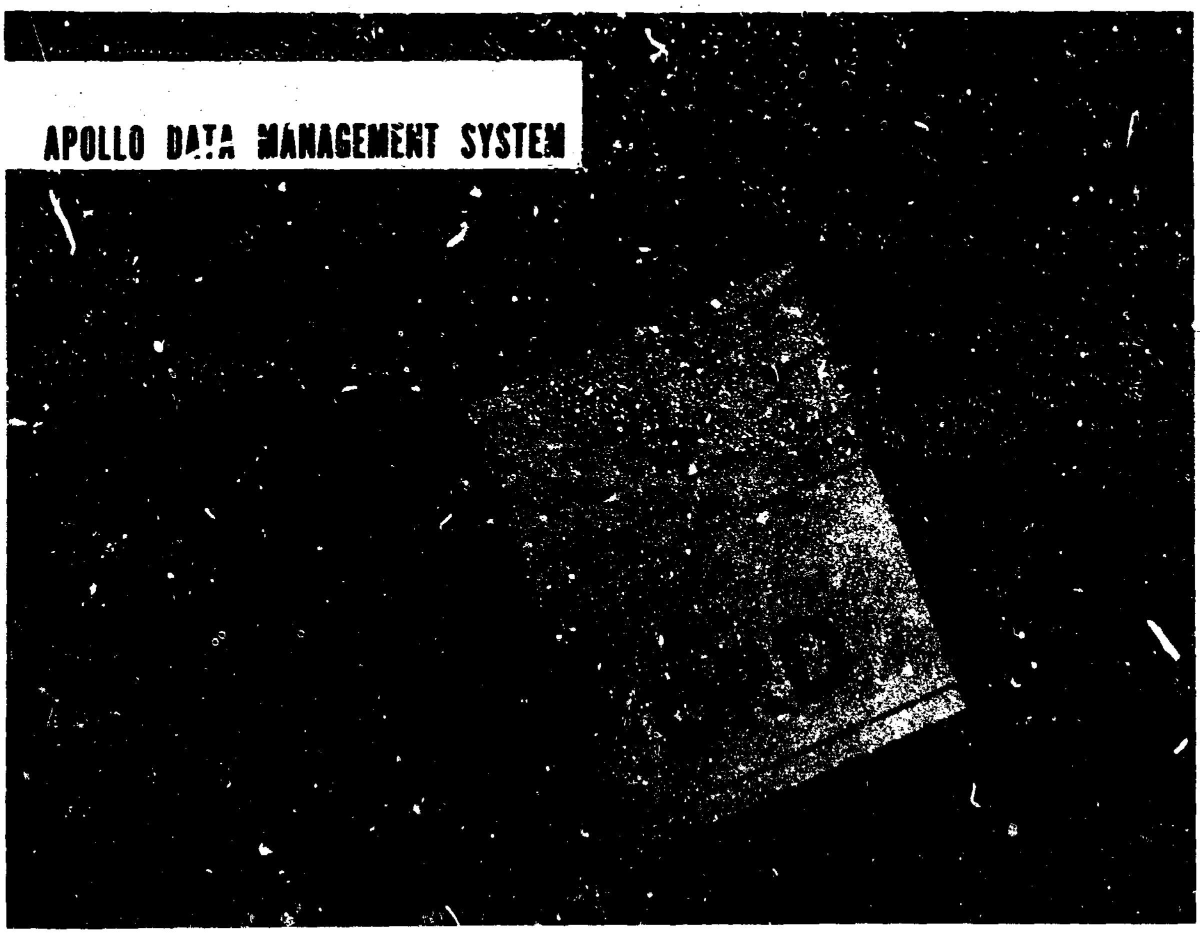
APOLLO DATA MANAGEMENT SYSTEM

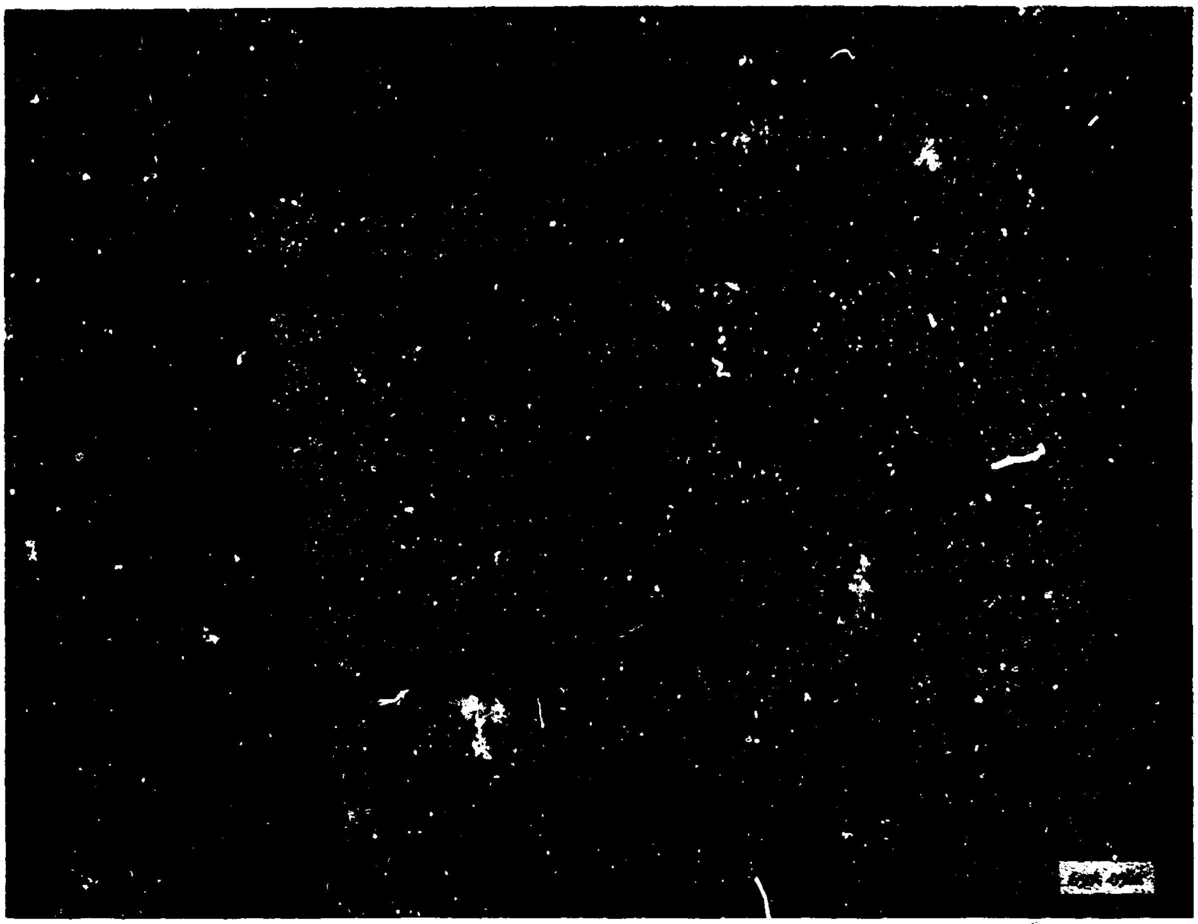


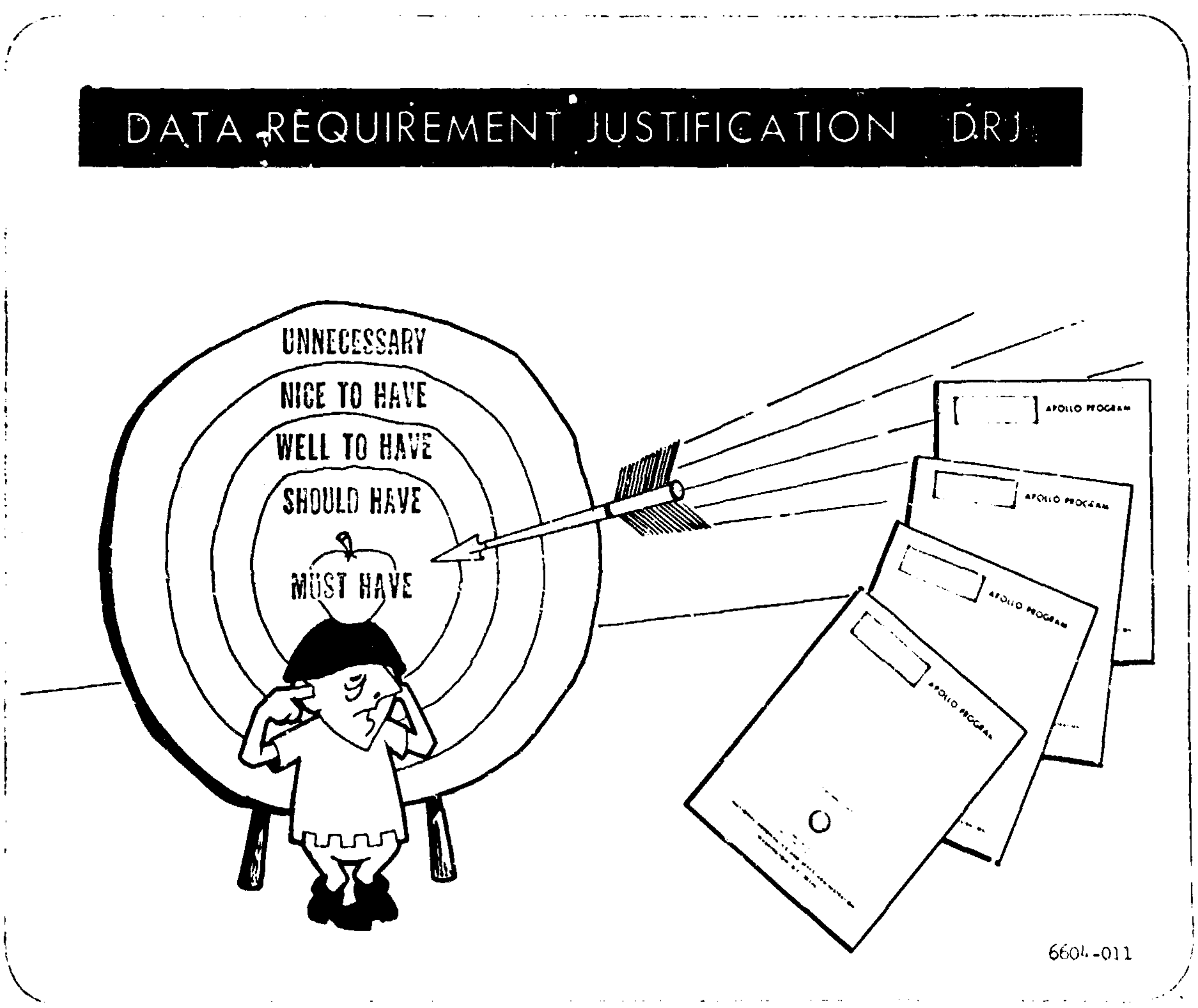
PRODUCTS

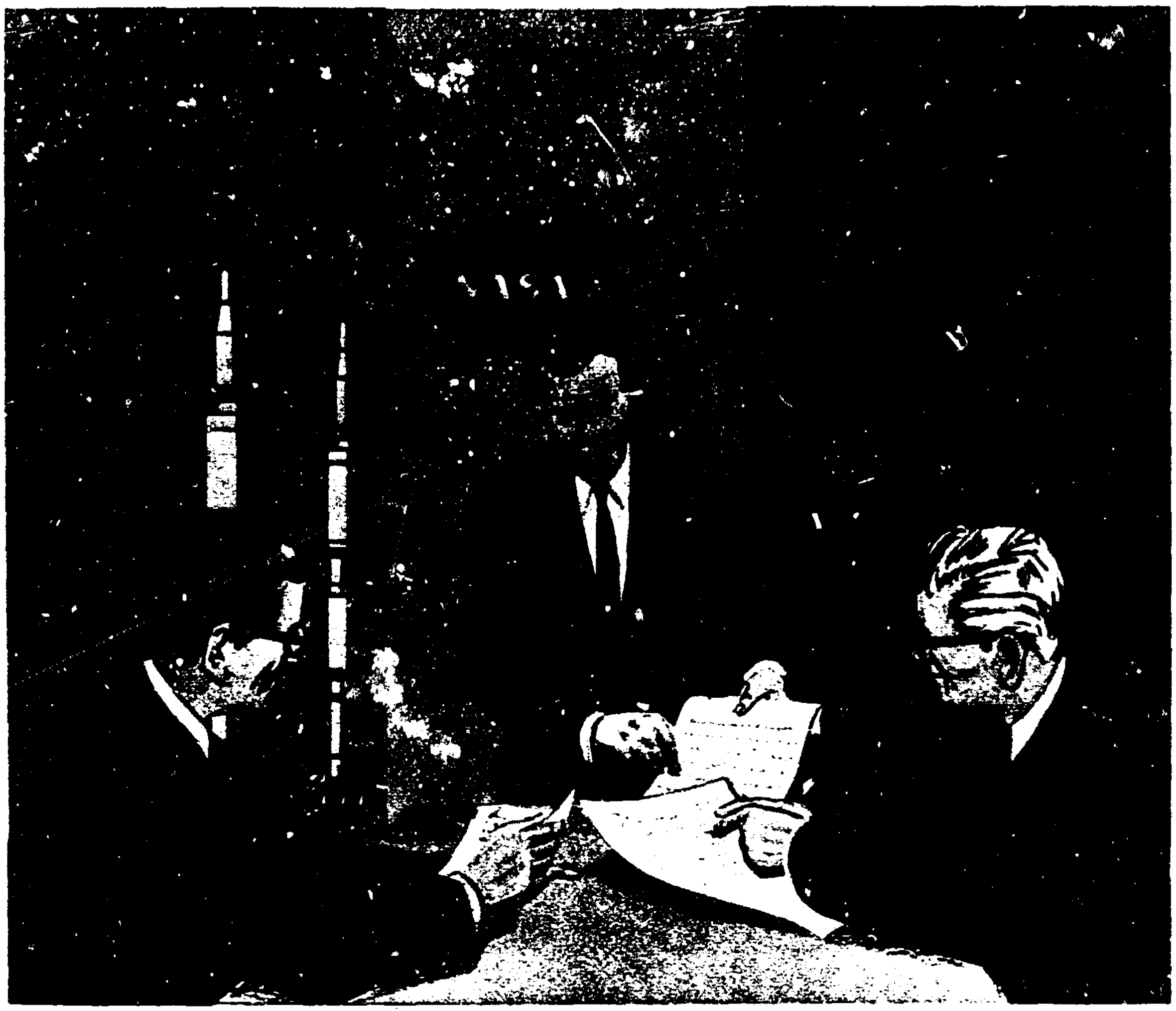
MUST BE

CONCEIVED	TESTED
DESIGNED	DISTRIBUTED
DEVELOPED	USED
PRODUCED	SERVICED






DATA REQUIREMENT JUSTIFICATION (DRJ)
UNNECESSARY
NICE TO HAVE
WELL TO HAVE
SHOULD HAVE
MUST HAVE
APOLLO PROGRAM
APOLLO PROGRAM
APOLLO PROGRAM
APOLLO PROGRAM
6604-011



NPC 500-7
DM001-001-1

OFFICE OF MANNED SPACE FLIGHT

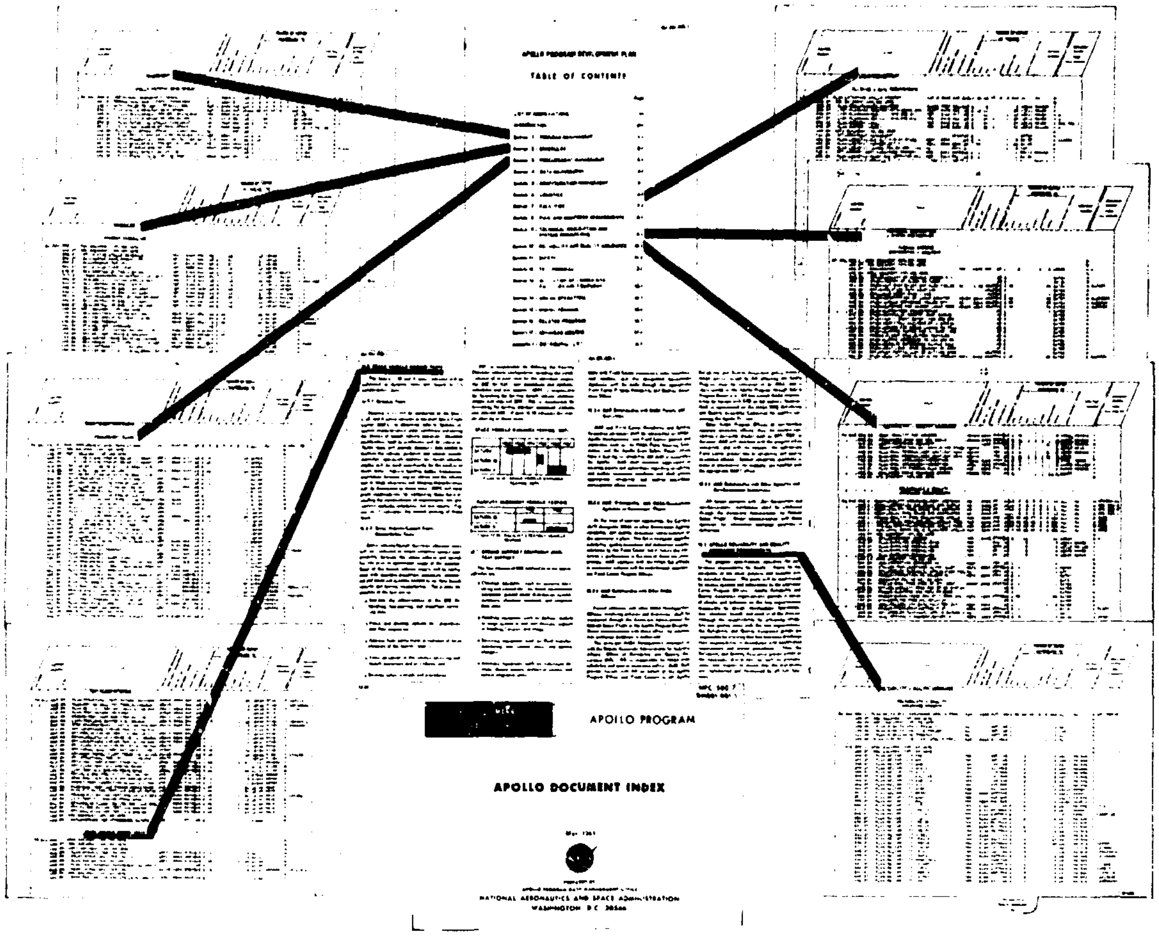
APOLLO PROGRAM

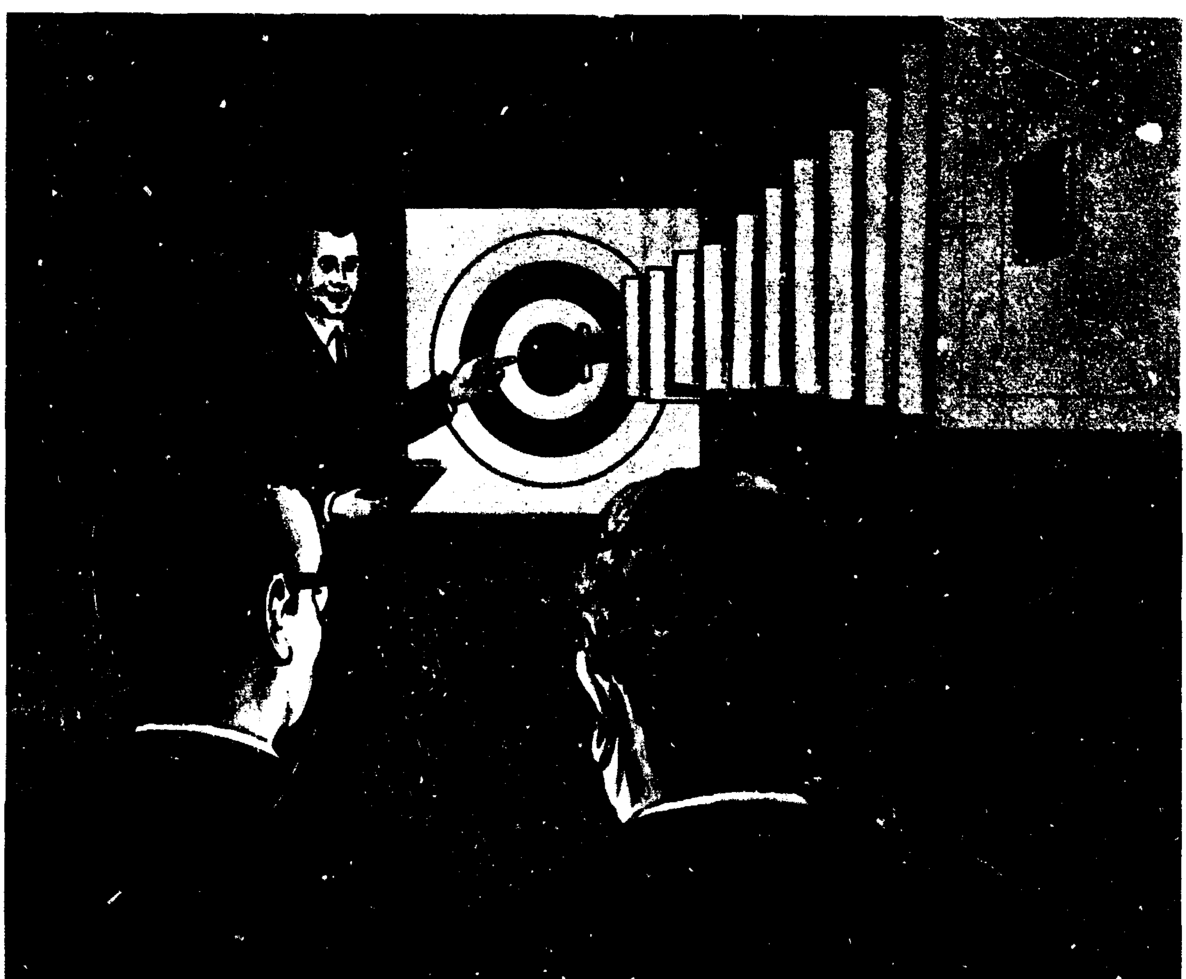
APOLLO DOCUMENT INDEX

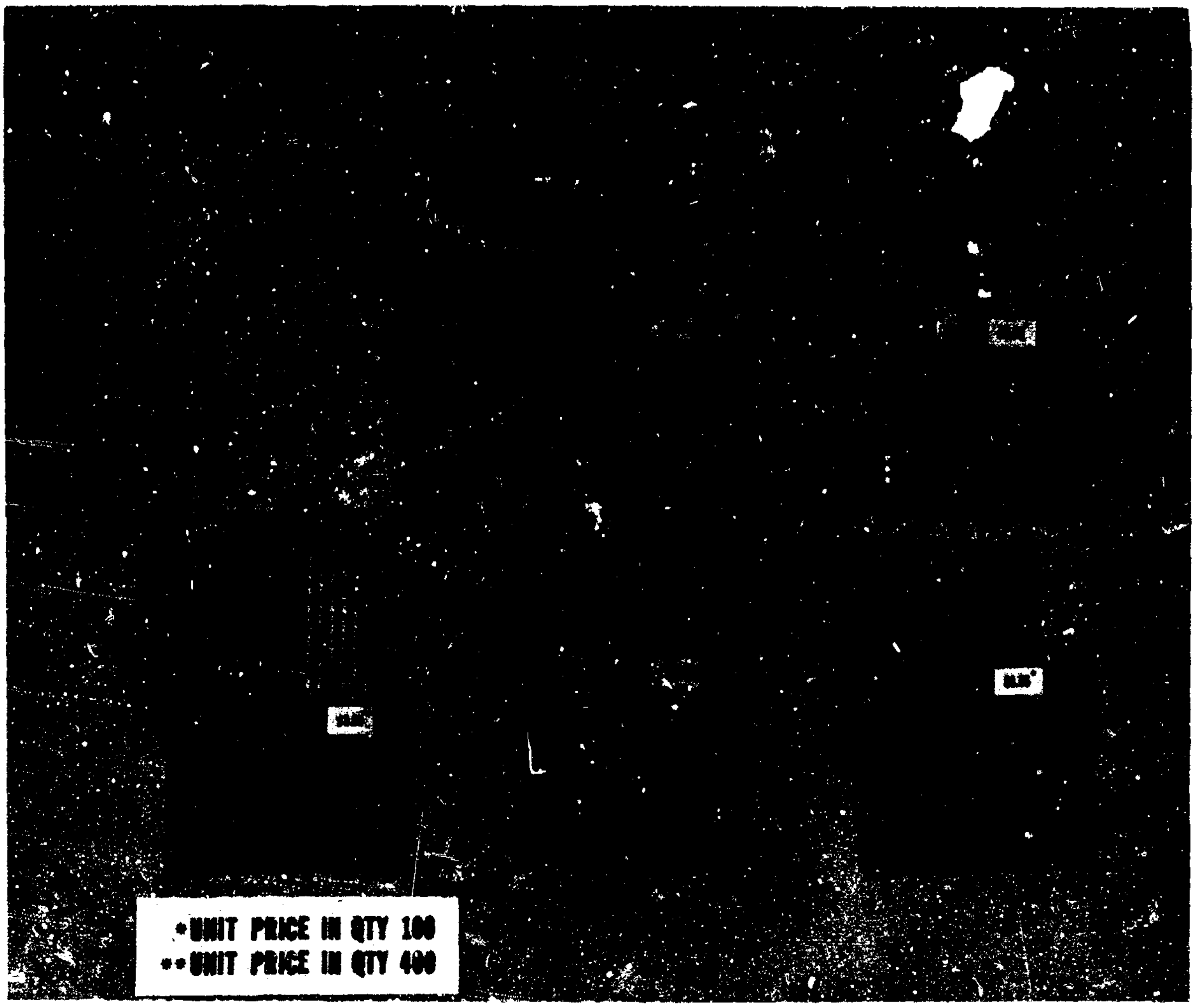
November 1965

PREPARED BY
APOLLO PROGRAM OFFICE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

APOLLO DOCUMENT INDEX
SUPPORTS APOLLO PROGRAM DEVELOPMENT PLAN

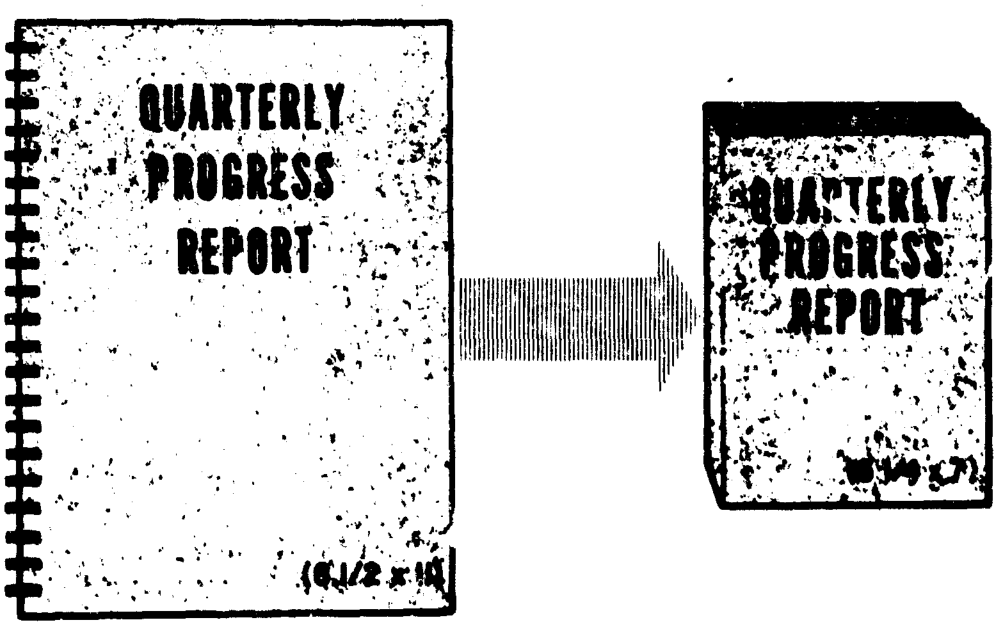


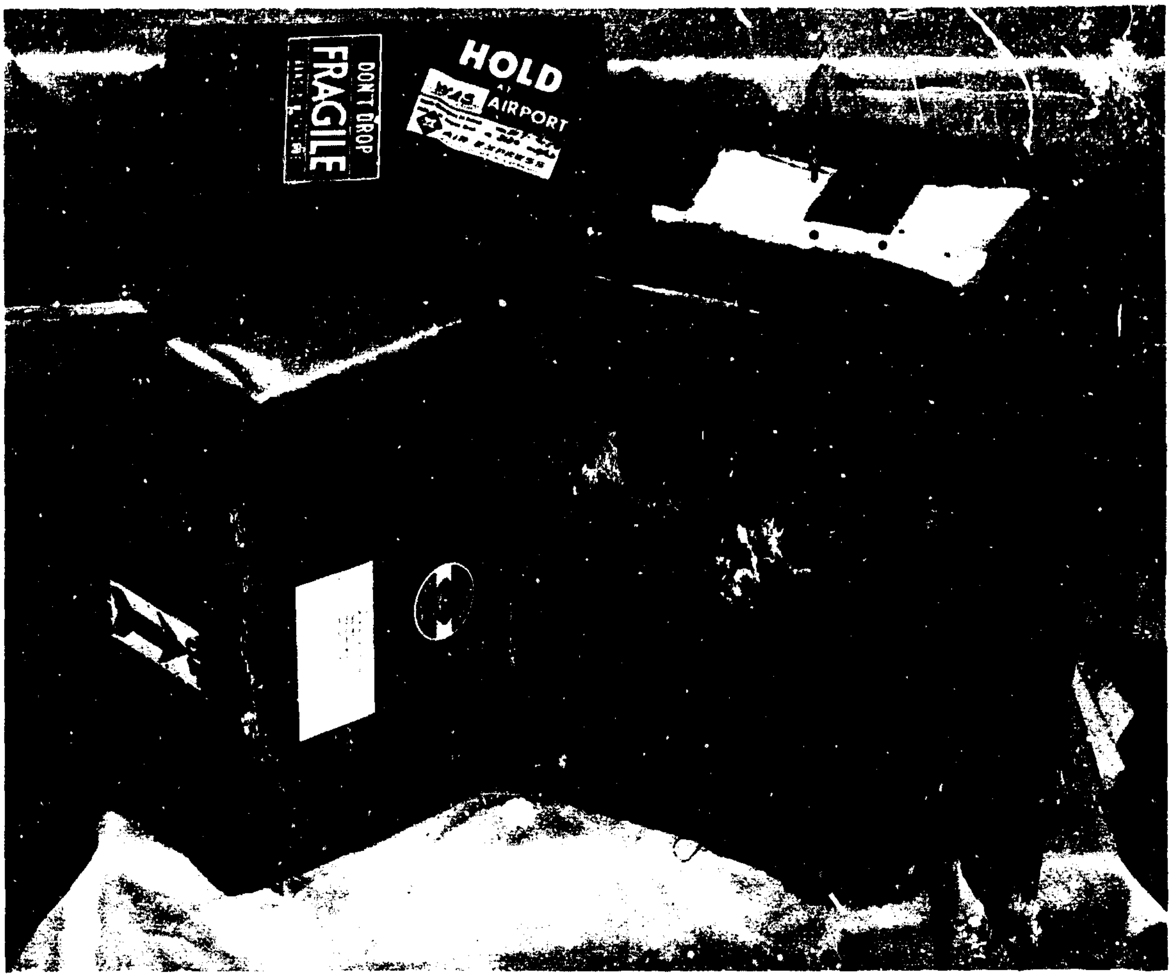


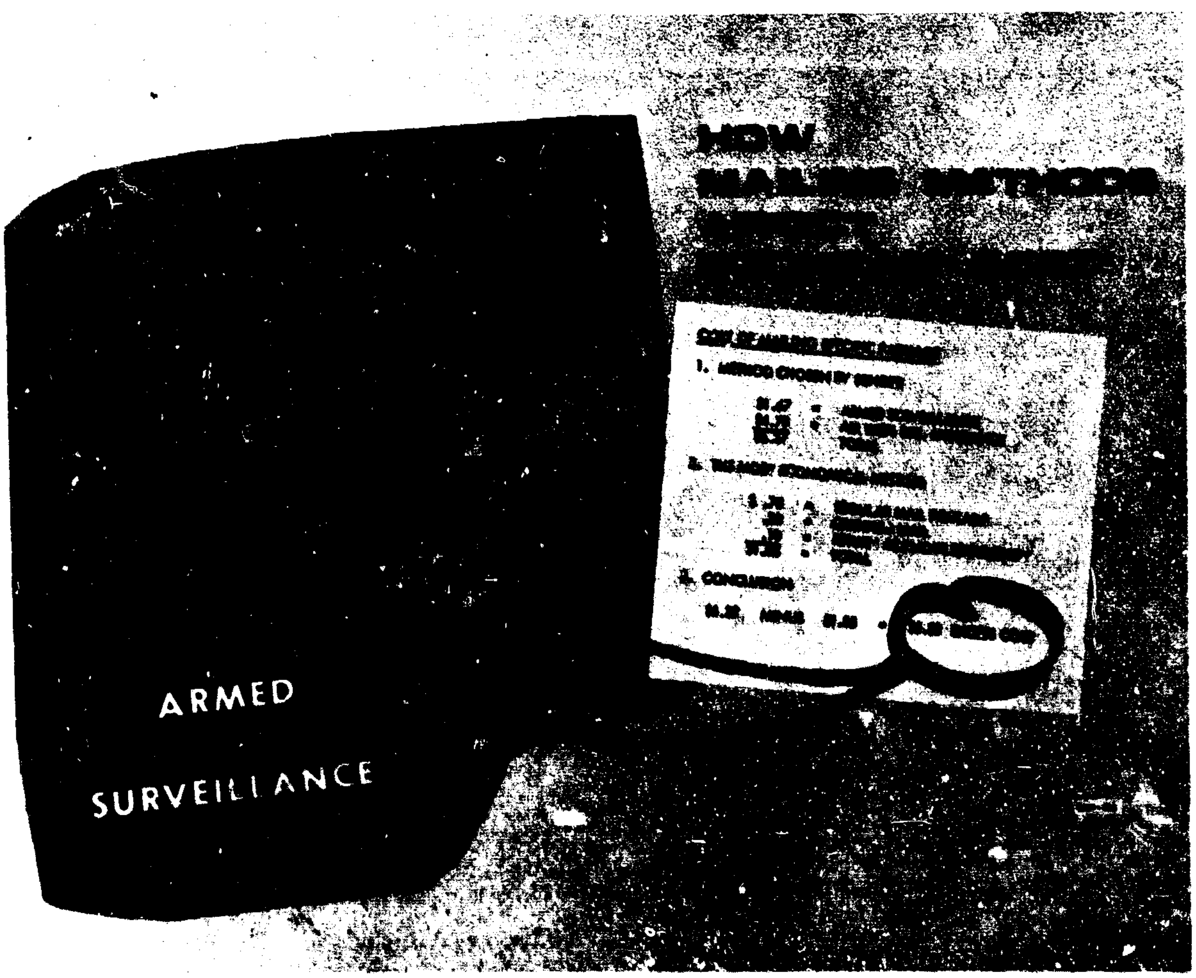


OPERATION PAPERBACK

MAKING LITTLE ONES OUT OF BIG ONES



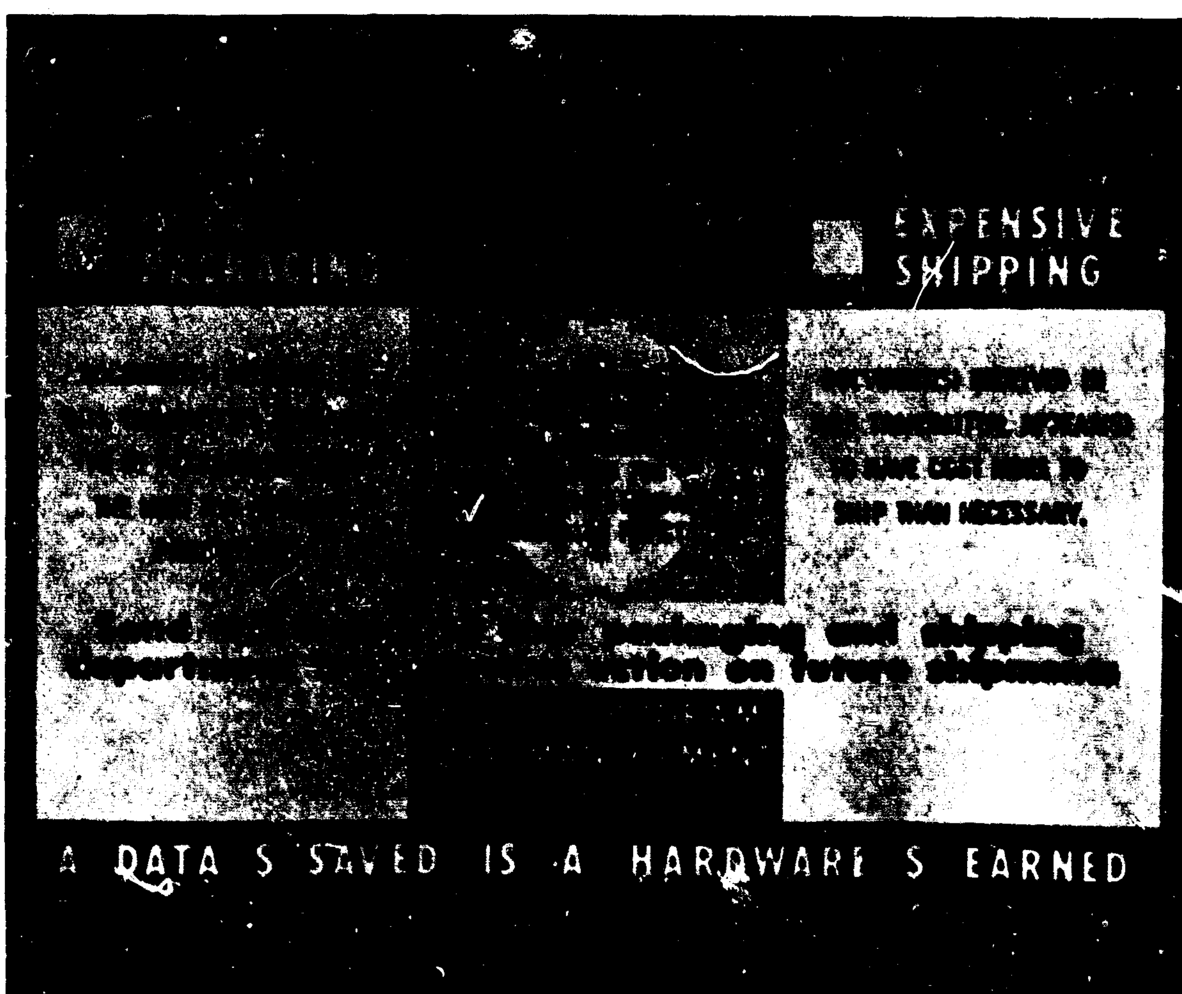

DONT DROP
FRAGILE
HOLD
AT
AIRPORT
AIR EXPRESS

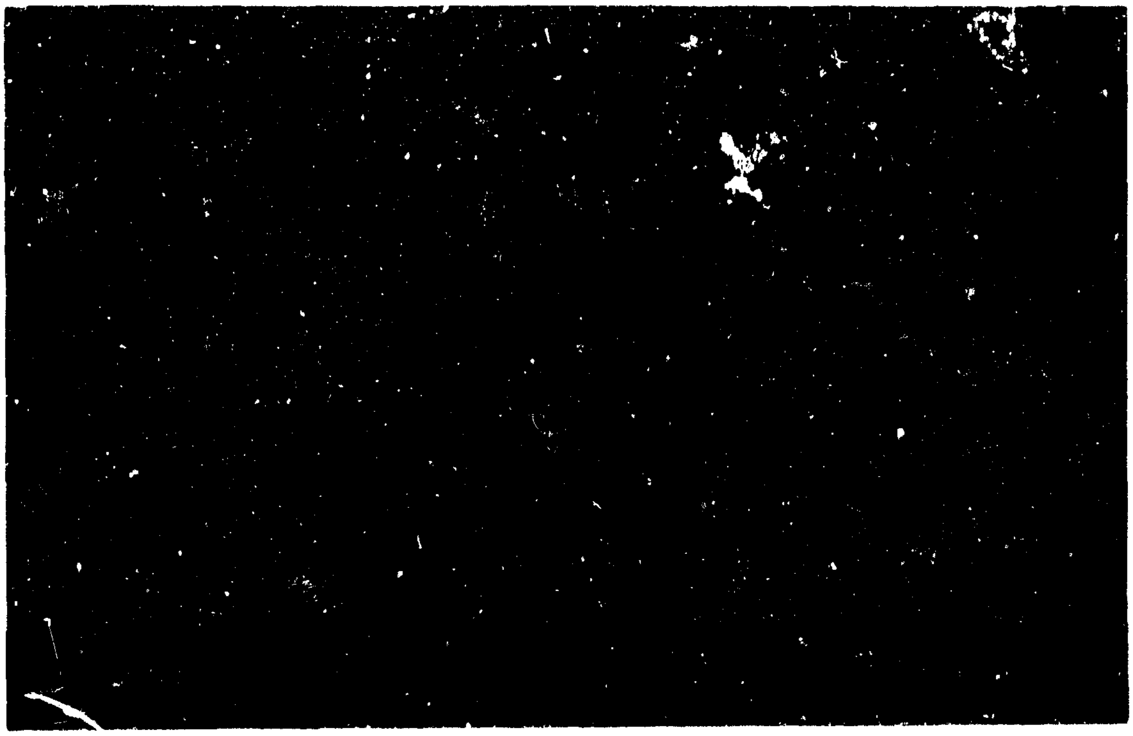

ARMED
SURVEILLANCE

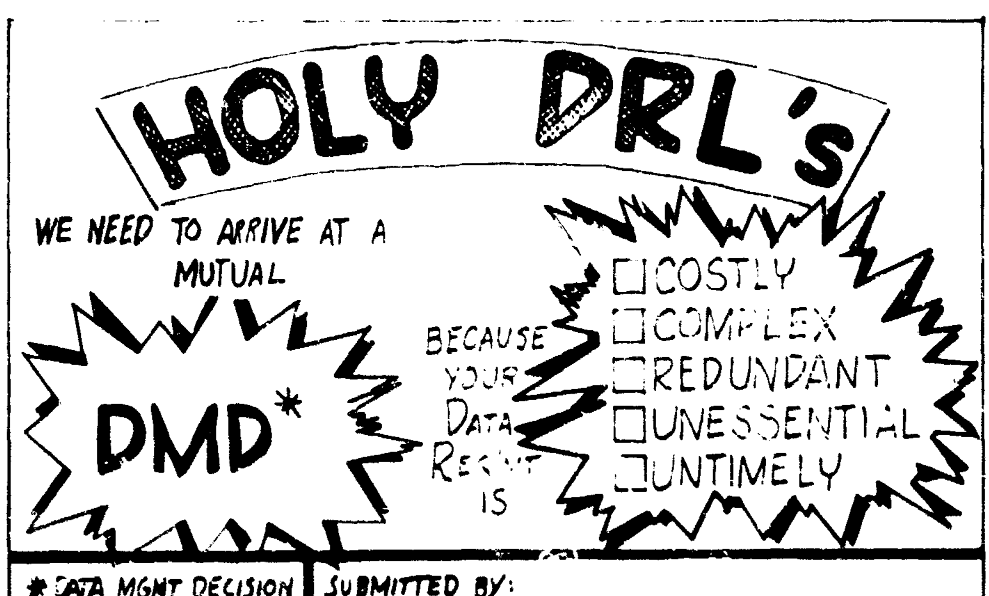
- APOLLO DOCUMENT COVER PREPARATION
- APOLLO DOCUMENT SIZE
- APOLLO DOCUMENT TITLING
- DOCUMENT PACKAGING AND SHIPPING

- APOLLO DOCUMENT WRITING GUIDE
- APOLLO DOCUMENT ABSTRACT PREPARATION
- PRINTING LAYOUT ECONOMIES
  (BOTH SIDES OF PAPER)
- FRONTISPIECE LAYOUT (REQUIREMENT FOR
  AUTHORIZED SIGNATURE; WHAT PARAGRAPH
  DOES REPORT RESPOND TO, ETC.)
- QUALITY CONTROL CHECKLIST TO BE INSERTED
  IN FRONT OF DOCUMENT
  - ☑ SIGNATURE OF AUTHORITY
  - ☑ EFFECTIVE DATE
  - ☑ ABSTRACT PREPARED
  - ☑ WORK STATEMENT PARAGRAPH
  - ☑ ECONOMICAL FUNDING & REPRODUCTION
  - ☑ COPYRIGHT RELEASE OBTAINED

6503-073







HOLY DRL's
WE NEED TO ARRIVE AT A MUTUAL
DMD*
BECAUSE YOUR DATA
IS
COSTLY
COMPLEX
REDUNDANT
UNESSENTIAL
UNTIMELY
* DATA MGNT DECISION
SUBMITTED BY:

QUESTION and ANSWER SESSION

B9

"Expert in the Barrel"

Moderator: Various

Panelists:
D. W. Dunn
J. L. Flippo
F. M. Grimes
Capt. F. G. Law
Lt. Col. W. H. Mason
C. A. Nazian
J. W. Roach
A. W. Snodgrass

QUESTION: Do you have any feelings at all with your experiences as to how deferred ordering of data might work on the major jobs? I am concerned more with NASA. We are supporting Marshall in this particular area and are looking at point to point distribution in something maybe as far out as this. There are, of course, cases of many engineering changes, a constant flow of engineering changes and it would be like having boxcar size orders on a daily basis. Do you have any feel just in this area? Could it be applied to R&D and could it be a savings in time and dollars?

MR. FLIPPO: We, in AFLC, have no experience on R&D contracts. We are attempting to apply this technique thru the DD Form 1423, on all data subject to delivery, calling for it to be delivered at the latest possible time the Government has a need for it. I would suggest that the question concerning R&D contracts be presented to Headquarters AFSC, Attention, SCSVN, Lt. Col. Rennhack. They are responsible for the R&D Programs.

QUESTION: On a proprietary item how would this work, have you had experience in using this system for competitive procurement? Drawing the data from one source and then when you need it, go out on competitive procurement, have you been successful? How is this paid for, do you contract for deferred ordering of data on some basis, and for how long is this coverage? Our type of items, for example, are in the system for maybe 20 years.

MR. FLIPPO At the present time, this technique is only being applied on large systems procurement such as the C141. There once again the rights in data clauses of the contract are equally binding whether the data actually accrues to the Government, as it formally would have under MCP 71-77, or it remains with the contractor to be ordered as required. When we order the data from the contractor, the same rights in data clauses apply. To answer your next part, concerning the pricing, we have a basic ordering agreement with any contractor with whom we engage in this approach. A pre-determined price for a square foot of blueprint, an aperature card or whatever we may be procuring from him. The feature of how long a period we have, as I indicated this morning, are still in what is referred to as a service test. Sometime prior to completion of production on each one of these systems, we will have to make a decision whether we want to bring all of the data in-house or whether we want to continue to negotiate for the delivery of the data on an as required basis.

QUESTION So you will make this part of your test?

MR. FLIPPO That will be the concluding part of the test. In the case of the C141, it will not occur for sometime to come.

QUESTION Similarly then, the cost of maintaining the data for Government use will also have to be determined?

MR. FLIPPO Yes Sir, as long as we have an active contract and we are buying huge quantities of dollars worth of equipment from the contractor, there is no problem. Someday we are going to have a completion date of the contract and at that time we will have to make a decision as to what data we will bring into AF Engineering Data Service Centers. But, assuming that we bring the data in at some future date, we will have eliminated the thousands of revisions, and the thousands of new drawings that have been added and deleted during this production phase of the program. This feature has already far exceeded our anticipated goals, and likewise the cost of the actual data that has been delivered to the Air Force has been much less than we had anticipated.

QUESTION — But in this case you do not have any breakout procurement to speak of?

MR. FLIPPO — We have data item P14 which is our competition with confidence program (the AF version of project breakout) where we have an agreement with the contractor and he codes items in accordance with MIL-STD-789 as to how we are going to reprocure the item. If we are not going to reprocure the item competitively the reason for the contractor's and Air Force's nonconcurrence in procuring the item competitively is required.

QUESTION — Source Control and Specification Control as defined in MIL-STD-100 both say drawing such and such describes or depicts an existing commercial item. There is a big ground in between that does not cover commercial items. Is this going to be revised?

MR. NAZIAN — It is being revised, however, the intent of keeping it for commercial item coverage has not changed.

QUESTION — Will everything between a Specification and Source Control drawing be called an envelope drawing?

MR. NAZIAN — No, but I suggest that this is a possibility. If, for instance, you are providing an envelope design and are not interested who makes the item, but your research has uncovered nothing that meets these requirements in the commercial market, you can still provide a design parameter type of definition. The envelope drawing in the MIL-STD-100 gives you that information.

QUESTION — Would you convert that drawing to a Specification or Source Control drawing upon the introduction of this item to the commercial market, if it became commercially available?

MR. NAZIAN — I probably would not, because it would most likely cost more than it is worth. It depends on the nature of the beast.

QUESTION — On the Specification Control drawings, we do talk about, in the present MIL-STD-100, the requirements for two approved vendors that have been tested. Is this going to be changed in MIL-STD-100?

MR. NAZIAN — Yes, this smacks of pre-qualification and all the specification control drawing will probably state will be that we have selected this item and these are known suppliers of the part. Now, whether or not the part conforms to the requirements specified is not an "a priori" requirement, it is an acceptance inspection requirement. The vendor has either produced an item that responds to the definition or he has not. It does not matter whether you are a contractor accepting a part, or the Government inspector that is accepting something. One must inspect against the contracted definition. This is different than qualification against a specification, however, qualification against a specification does not eliminate acceptance inspection.

QUESTION — In the revision of MIL-STD-100 there will be something that will eliminate this requirement right not for two qualified sources?

MR. NAZIAN — That is right, there will be sources but not the word qualified. Actually this was supposed to be nothing more than a shopping guide or an aid to a contracting officer. However, when it is convenient to supply information to a contracting officer, we will place this information on the specification control drawing.

QUESTION — In the keynote address that was given for General Stanwix-Hay, it was mentioned that we should all be looking toward the future when we could use computer type data. This is right now in conflict with some of the items that are called out in MIL-D-1000 and MIL-STD-100, with respect for instance, to vendor callout on specifications. It would be much more convenient for us and I am sure that this is true of other industries, to provide the military with a list, for instance, a computer list or a tape of approved vendors on particular company items. Rather than have this on the face of the specification where it involves revision entry on the specification and a continual up-date, we would like to go to a system that allows us to update the computer by IBM cards. Can we see the day when we as contractors will be allowed to do the same thing on specification and source control and envelope drawings? Where we do not have to show the vendor on the face of the specification but can give you a tape or an auxiliary list?

MR. NAZIAN	I would expect that within the next six months or so this will be clarified completely because we are going to the policy people at DoD/OSD to get an answer on this.
QUESTION	Do you anticipate that this will come in time for the revision of MIL-STD 100?
MR. NAZIAN	Hopefully it will.
QUESTION	If the Government does ask for drawings on their format with their numbers, is it axiomatic that it must therefore be Form 1?
MR. NAZIAN	That is right, in terms of MIL-D-1000, this is precisely how they would order it. They would say Form 1 and then the category for design disclosure parameters.
QUESTION	Then Form 1 need not be Government format, Government drawings?
MR. NAZIAN	The specification calls it out rather clearly. Form 1 is against MIL-STD-100 which provides you the Government format for the drawing, however, the Government does not necessarily have to supply you with it, but you must have name and number on the Form 1 drawing. This can be done if it is permitted by the contract or by the request. The data manager may decide he wants to go this route as his particular in-house control system may be such that he can accept contractor numbers. It may cost more money to convert. He has to know all these things and make a decision early in the game.
QUESTION	Is it not so that where the Government calls for Form 1, really, the only difference between a Government format, Government number, and the contractor format is that little number at the bottom and the format?
MR. NAZIAN	Essentially, that is right, if you are following a Form 1 requirement.
QUESTION	If this drawing is an assembly and you have a lot of callouts, is a list of materials allowed either on the drawing or off the drawing?

MR. NAZIAN — Either one is allowed. The man who orders the documentation decides this. He makes this requirement loud and clear when he goes out with his data call.

QUESTION — What kind of problem does he have if it is put on the drawing?

MR. NAZIAN — A list on the drawing leads to many internal problems on how you handle your data. In my own operation, I cannot have a data list on the drawing. All of my data lists, within the next 18 months, will be automated and I will just receive input cards and never get a data list as such. The by-product of my data list is a technical data package list which provides a technical data package to go out on procurement. It lists everything needed and can and does do many things other than what drawings do.

When I don't need this ability, I can put it on the drawing. Form 3, Category A, for instance, which is a design evaluation, can be accepted that way, but if the item is going to go into a logistics system, we would have problems.

QUESTION — If you do have this Government format drawing requirement, does this mean that on the list of material on a given drawing, that you cannot use any commercial part numbers or any of your own company standard part numbers?

MR. NAZIAN — No, it does not say that. Your requirements for your parts lists pretty well spell out the identification in these situations. If you have used items that have these discreet identifier numbers you are supposed to list them. However, if the requirements of MIL-STD-143 apply, then you have another problem because you must translate some of these identifications into what we call higher level documents, either a nationally recognized industry standard or up the line to a federal standard.

QUESTION — MIL-STD-143 governs it then, and if you transfer it up the line, then you must, but if there is no existing standard, can you then use for this item the vendor's number or your own company standard?

MR. NAZIAN — Yes, but then you must also in addition provide a copy of that document complete to the extent that we have ordered a category copy.

QUESTION	The copy then, must it be on Government format?
MR. NAZIAN	Not necessarily. My advise is to look carefully at the particular situation in terms of the category and in terms of the forms situation.
QUESTION	We have a Martin specification of an internal Company part. Would we have to re-identify and put it on another format to meet this requirement?
MR. NAZIAN	If it is in keeping with the category and Form content, "no", it would not necessarily have to. You have to be precise in this respect. You will, however, provide copies of all of this information.
QUESTION	Do you have any problems with people complaining about book form drawings, revisions to them requiring page after sheet 1 and all that sort of thing?
MR. NAZIAN	Yes, there are some in that area and it escapes me at the moment as to what we finally put in the MIL-STD-100 document. I am not sure whether we said to put the revision on every sheet or not. I do not have the MIL-STD-100 draft with me.
QUESTION	If you put these revision sheets after sheet 1, it necessitates re-numbering every sheet per the data processing route. So, all we are doing is putting the first ones on the front sheet as far as we can go and then putting revision sheets at the end. Are you looking into this problem?
MR. NAZIAN	Yes Sir, that is one of the things that come up and we are looking into it.
QUESTION	On the 1423 Form they ask for a price on maintenance mission items, source code MM1. I put my company in the red because I quoted this and it was based on my estimation of how many drawings would be submitted. When they came in with the requirements, they requested an extremely large amount of drawings. I looked up past records and found how many drawings had been source coded MM1 on a similar piece of equipment so I based my quoting on this. I was stuck with microfilm way above what I quoted. Have I any recourse other than to use this example as a guide and increase my quotes accordingly?
MR. NAZIAN	I would say that the package that you bid on was not adequately defined for the number of drawings, and you responded to a weak definition. Under the concept we have right now, it is the Government's

MR. NAZIAN (Continued) responsibility to completely define its requirements so that not only the contracting officer but also the contractor is fully conversant with the requirements. Under that situation, I am sure that you could come back and then come in with a price on something. It is your business to do this. The data manager must make sure that all of the requirements that he visualizes for this thing is spelled out otherwise, he is going to price himself out of business too.

QUESTION I advised the Marketing people that I was going to quote these items on a no-quote basis, that I would quote them when I knew what the package consisted of, and they turned me down. Is this proper?

MR. NAZIAN Certainly, how can the Government then judge you against the other RFP's? You have to put the dollar numbers down.

QUESTION On most 1423's lately, in regards to the procurement source quoted "P" items, they tell you they are to be negotiated later. Should it not be the same for source coded MML items?

MR. NAZIAN That is the way it should be. If they cannot tell initially, they should say that after such time as we know precisely what we are going to do, we will negotiate the package.

QUESTION The Engineering Documentation Section of the American Ordnance Association has capabalities, I think, that would be of benefit to NASA. A lot of years of experience of our members and we are certainly looking forward to any assistance that we can provide to you. We have not been too successful in years past in getting together on the NASA/AOA documentation subsection, is there the possibility that we can?

MR. DUNN I believe that in order to get something concrete going, you should write a letter to NASA and indicate formally your desire to create this situation of participating a little closer. I would say that you probably should address this to the Administrator.

QUESTION Do you have any evidence as to the extent of the contractors problem relative to differences in Government forms and formats as concerns configuration management or other kinds of Government reports?

MR. DUNN — No, I really do not. I can only speak from the standpoint of data management and currently we are only laying on two forms, that is the DRL, which is the 1423, and the DRD, which is the Form 9. As far as my responsibilities for generating these forms at the present time, I am only guilty of two and as I said in my speech, we will use the 1423 or the Form 9 as long as it has all the information in it. By that I mean, if it has the kind of information that DoD would require, we require exactly the same. I have seen a lot of Form 9's, and you probably have too, that just do not cut the mustard. Until we have a Form 9 that first of all delineates the data needed, I mean in depth, I do not think we have really solved the problem. We have a long way to go in having people actually define what they really want in terms of data. But I would have to refer you to Hal Holland on the configuration management form because they are the responsible people for generating them.

QUESTION — Are samples of DRJ Forms available? We have been trying to develop one of our own and I, like you, would just as soon plagurize.

MR. DUNN — Yes, they are. I do not have any with me. If you just give me either a phone call or write us, we will be glad to give you copies of the DRJ's.

QUESTION — The Navy has taken a completely different approach to the ADL than the other two Services have, and it appears that even the Air Force is getting away from the Form 9 now. They are saying, for example, that they are too long, let us get the requirements back in the specification where they are within context. Which direction is NASA moving?

MR. DUNN — This is a subject dear to my heart. The NASA system that we are trying to push is that we would rather see discrete Form 9's, or DRD's, on every contract until we have gained enough experience to standardize. At the present time, I do not believe that there are very many standard Form 9's that can be applied across the board to contracts. There is always the exception made and we are leaning towards creating a Form 9 or a DRD which is, in effect, a shopping list of all the best ways to lay on a data requirement for a specific type of an operation. Then we would give this particular standard form to the line organizations and say to them, select the specific element of this DRD that has application

MR. DUNN (Continued)

to your particular program. This is the way we see a standard at this time. Now, in so far as, should we stay away from Form 9's and just refer to specifications and standards, I will be frank with you, we have not had enough experience to make the decision. I would be the first one to admit that it is ridiculous for us to re-copy a standard and put it on a Form 9, particularly if we are going to copy say 20 to 30 pages or even 200 or 300. At the present time we are trying to insist that at least if you call out a standard, call out just exactly that part of the standard you want to impose and we insist that you have a negative approach and say these things that are in the standard which will not be used. Now this is what our thinking is at the present time, but the problem of replacing standards and specifications and existing reg's with DRD's, or Form 9's, I do not think we have enough experience to really say which way we will go eventually.

QUESTION

Is there any data or studies available on Value Engineering on this technical data, or R&D reports particularly?

MR. DUNN

Yes, we have a standard out that is in draft form on Operation Paperback which tells you exactly how you will apply Operation Paperback to any kind of a report. We have, of course, a standard on packaging and shipping of documents and we have about 10 or 15 in the mill. They are in various stages of preparation. For example, we have one that is just about finished on a standard for indexing, in other words, how will you produce for us indexes of documents generated by the contractor.

QUESTION

Can you tell me more of the sort of intrinsic value of the content of the report, rather than in the various things you have to to process it?

MR. DUNN

Yes, I get your point. We have a standard on Preparation of DRD's and DRL's and this is just a good IG check list, which identifies what makes a good data requirement description, it tells you what should be in the scope of the data requirement description, how should the data requirement description be prepared. I think at the present time we have something like 50 elements that we check and say look down this list and if you have answered all of these questions then you pretty

MR. DUNN (Continued)

well have created a good data requirement. You as a respondent to this DRD then would be in a position to take this particular data requirements laid on you and create your document, and hopefully, if we have done a good job then of laying on the requirement, you will have a technically adequate report. We have done a lot of work in this area and think there is a lot more work to be done. As you know, you can get volumes on how to write a good technical report. Right now we are in the throws of selecting what we think will be the best elements to put in a document requirement description work sheet which will assist our people first. Remember, you cannot do a thing until our people give you the intelligence of how they want this technical report created, how they want it organized, and how they want it framed, amd what should be in it.

QUESTION

Are you going to apply that DRD process to our reports now for the things we produce?

MR. DUNN

Definitely, you should get a request from us asking you to write a DRD. We have prepared one. Remember, we are both in this game together and my position is, why shouldn't we both use our intelligence. If I put what I think is right down I am sure that with the experience you have had, you must have some good ideas, let us meld them together and then we will come up with the best one. So, we say to you, you prepare a DRD for us, we have one, or are working on one, and then we get together and say this is the DRD that is really responsive. We are doing this with all of our contractors, Marshall is doing it with all their contractors. So we are asking the contractors, where it is possible, you write DRD's, you know as much about this business as we do, and you tell us what you think you should be doing, what should be in these reports, and it fits both of us.

QUESTION

What action is being taken to standardize on configuration management terms and terminology related to specifications, baselines, inspections, etc.?

MR. ROACH

This is a real problem. As all of you recognize, the Services are at least, let us say, semi-autonomous.

The purpose of OSD is to ask for something to be done. To establish the Program Requirements

MR. ROACH (Continued)	Baseline or Baseline 1 and then to let the Services do it - to accomplish the job as is best, in their judgement. I believe this is the correct way of doing it.

This obviously does not help in standardization. We are trying to straddle the fence and I really cannot give you a good answer to this question.

As you recognize, our directive has certain terminology in it. This terminology differs from the terminology that each of the three Services use and differs from the terminology used by NASA. I do not think it is appropriate for OSD to direct that the terminology for baselines be exactly as it is in our directive. I do not think it accomplishes any useful purpose. I think the slight difference in terminology, as long as the baselines mean the same thing in definition, can be accommodated. I do not believe that in any company, the corporate structure dictates exactly the terminology to be used. Essentially the same is true in the DoD, with OSD equivalent to a corporate office and the various services equivalent to a division. I don't believe DoD should try to be authoritative in this regard either.

We should try to assure that when the Air Force talks about program requirements baseline and OSD talks about functional characteristics baseline and one of the other services talks about something slightly different in terminology, that we are all talking about the same thing. That is the best answer I can give you.

QUESTION	Some contracts now provide for varying levels and types of supplier configuration control based upon complexity and criticality of the item. Are such provisions going to be spelled out in new DoD or Navy Configuration Management Regulations?
CAPT. LAW	I do not think our approach would be greatly different from any of the other services. Speaking for the Navy, we anticipate the degree of control depends on the complexity of the item, interface problems it generates, controls, or contributes to. Good selective management should always prevail. I think if we do this we will accomplish the purpose.
QUESTION	Is it really necessary for the government to specify in detail the methods to be used by the contractor in producing items such as Configuration Status Accounting Reports?

COL. MASON — I do not think it is necessary. In fact, the military standard on configuration accounting will not specify the method. It will specify the product to be produced, namely, the key elements that you must account for in conjunction with a configuration change. Now we do offer a specific method in AFSC Manual 375-1 that could be made optional as a method. As I say, the DoD MIL-STD will not require this as a mandatory condition.

QUESTION — Can a prime contractor allow for supplier configuration management training costs as a line item in his contract?

MR. GRIMES — I do not pretend to be a procurement expert so I am not going to try to do much with this question. I understand there is an ASPR clause that makes some provisions for training costs, but I am not familiar with it in detail so I am afraid I will have to duck that one.

CAPT. LAW — I do not think I can sit still on this one. I feel that if there is no increased cost to the government we certainly are not going to object to what you do with your subcontractors, but otherwise I think it has to be covered in the prime contract with the limitations spelled out. Regardless of what ASPR may say, I am sure that ASPR will support that sort of philosophy.

QUESTION — ANA 445 provides for approval of Class II change classification concurrent with the contractor's release. There has been a trend towards government technical approval of Class II changes prior to the contractor's release. What is your agency's position on this subject?

COL. MASON — The Air Force policy on this is very clear. It is that Class II change activity is the inherent prerogative of the contractor and the government's only interest in it and only right is to review for the proper classification and that it is properly classified as a Class II change.

MR. ROACH — Not that I disagree at all with Bill but let me delve into it a little bit more. We have run into a lot of trouble with Class I and Class II in trying to actually define them. Trying to define them has gotten us into all kinds of difficulties in the configuration control standard on Class I and Class II waivers and deviations. Actually, everything that concerns the physical characteristics of

MR. ROACH (Continued)

an item while you are operating under a system performance specification will generally be Class II because we are only governing to system performance and therefore dimensions and that type of thing will generally be Class II changes during development.

Now where this will not hold true will be those situations where we put into the system performance specification certain design constraints that you must meet. These have a tendency to be physical in their nature. Let me use an example. The C142, could possibly have had a design constraint on the size of the cargo compartment so that the Lance missile in its erector-launcher could be carried. Changes to that constraint would, development under a systems performance specification, be a Class I change. But all other physical characteristics would be Class II during development.

When a product baseline is established, there are far fewer and in some cases there could be no Class II changes. It depends on how deeply in the work breakdown structure identification we go because of desire for reparability or the desire for competitive re-procurement or for breakout. It could very well be that every last nut, bolt, and screw is controlled in which case there would be no Class II changes.

Obviously that condition normally does not exist because, in practically everything we buy, we have some commercial items and in commercial items anything below the form, fit, function of the total commercial item is Class II.

QUESTION

Do you visualize the necessity for Defense contractors or NASA contractors to establish separate identifyable functions labeled Configuration Management and if so, how are they going to avoid this charge of cultism?

COL. MASON

As far as I know, the government does not dictate how a contractor will organize his business unless we do specify in the contract itself that you will have a project type of management. I do not feel that we should, as far as I am concerned, dictate whether you have a specific functional area so designated for configuration management. That is up to you.

CAPT. LAW

The question he asked was, "Do you think he should have one", and frankly I think particularly at the beginning you are going to have some people until the other people become indoctrinated in the procedures and methods of doing things - this will probably save you some money too. Of course the purpose of the whole exercise is to bring better control and to identify those things which we should be doing and control them and eliminate unnecessary control.

Now this does not mean you have to have rigid control up and down but we certainly must identify the things that have to be controlled because your costs are important to you too and they determine how much money you make. If you do not control the one's that you ought to control, you will find yourself doing things over at considerable expense at times. Sometimes it is covered in the contract and sometimes it is not.

QUESTION

Do you think that configuration management is analogist to these other disciplines that again have been referred to as cults, in so far as that they attempt to fill a gap or improve a situation which DoD and NASA feels in need of improvement and can be improved only by assigning the responsibility to specific people trained in the disciplines?

CAPT. LAW

Well, I think that you must make it clear. I think that you have to understand that what we want to accomplish is to identify. First identify what it is you want to control, control it and then keep records so that you know where you stand. This is what you are trying to accomplish really, to identify those things which need controlling and control them and this is something that you will want to permeate your organization. You just do not want to exist in a small entity. I am sure that small entity may be necessary to do the missionary work but this is something that has to permeate the whole organization to be successful. It is not something where you can sit up at the top and crack the whip and close the book and expect it to happen. It is not going to happen unless the people that are doing it can see the advantages to their operation and sometimes this takes a bit of selling. I do not know whether I have answered your question or not, but I hope I have.

QUESTION — I am not sure either, Captain. At the present time we have a corporate policy which says that each division shall have an identifyable configuration management function and I am presently put in the position of commenting as to whether we should have such a corporate policy and I would appreciate your comments.

CAPT. LAW — I think we must have ways and means of identifying our interfaces. For example, in controlling them so that what we do in one place does not affect somebody elses operation. You do not proceed independently. Of course this is where we have had much of our trouble in the past and why we really precipitated so many changes. We have had one guy over here doing something to make his little piece right without adequate consideration of how it effects someone else. So if you identify what you must control and that which has interfaces I think you will make money.

QUESTION — Is my interpretation correct in what you said? You feel that unless some individual or group, depending on the size of the company, is given a specific responsibility for generating policy, educating people, etc., that you are not going to get a high level of control of configuration management?

CAPT. LAW — Well, I think a lot depends on how complex your operation is. Sometimes this can be a one-man execution. He can control and run it all but if you get into a big operation then it becomes bigger than any one man to see that it is adequately done.

QUESTION — Is there any philosophy right now which will extend the configuration control baselines that Mr. Roach professed that is beyond product baselines, in other words, to the operational or use baseline?

CAPT. LAW — After you have established a baseline there is a need to know where you stand. For instance, if you have established a baseline and you are going to make subsequent changes to it, you have to identify the changes you made to a particular baseline so that people know what you have and where it is. We have plenty of examples, for instance, in some of our systems at sea where we are spending an awful lot of money going back to try to identify exactly what we have because we have some other people making changes to things that do not exist out there.

QUESTION — When are you going to put your foot down on unauthorized alterations and modifications?

CAPT. LAW — Part of the discipline is to prevent this. These have to be controlled. You do not make a change without it being properly authorized and then you must record and document it. This is the idea of the whole system.

QUESTION — Would you be better off in just knowing that a change had been made and allowing the operating forces to give you an easy access route for affecting a change in a particular baseline configuration?

CAPT. LAW — I know our weaknesses. I am not sure I know how to correct them all or how to insure without the cooperation of everyone that the discipline that is required is followed, but I think we all recognize that some discipline is required and it has to be rigidly enforced.

QUESTION — Do you intend to extend the baseline control that you have presently on the contractors into the operation field?

CAPT. LAW — Well once the contractor, for my money, has delivered something then it becomes a new problem. Not as far as the contractor is concerned but as far as the Navy is concerned. The reference point is different. We always have to know what our baseline is, that is, what we are talking about.

QUESTION — When a contractor delivers a product to you is the responsibility of the configuration of that article no longer his?

CAPT. LAW — No, I am saying of the delivered article. You are trying to be too specific. It depends a lot on how a contract is written and what we are talking about. If you are talking about, for instance, a ship and you have a specific power plant there and it is identified, it is our baby after you have delivered it and we have accepted it.

QUESTION — To be specific, a Polaris missile is delivered to the Navy. Unfortunately, Lockheed does not relinquish the responsibility for the knowledge of the configuration and if a future modification to that delivery is necessary, how do they get this knowledge to the proper people without going thru a chain of command that dies on the vine?

CAPT. LAW	You have a special situation in the Polaris Program, in this current support that we have and how we utilize that support. Now that is a specific case. You are really worried about the day that we go to in-house support and we are not quite there yet.
QUESTION	Can an operating unit submit an ECP to the Air Force, to the Navy, to the Army in the operating Armed Forces?
CAPT. LAW	Certainly, this is part of the system. We have a system for the feedback from the forces afloat. It does need a little streamlining and this is what we hope to accomplish in our efforts.
MR. GRIMES	This is an EIR in the Army, but it should get into the same channel.
QUESTION	We have recently been screening items thru the Defense Logistics Supply Center (DLSC), and they come back with FSN's for them. Now, our problem is, having the FSN for this. How do we get the drawing support so that we can go ahead with the procurement package?
CAPT. LAW	I would say the answer to that question is ask DLSC. They should provide you with what they made the decision on.
QUESTION	We are getting a stock number for an existing item which they want us to use from inventory and on a new item. There is a savings to the government for us to use it even though it may be a design increase. DLSC tells us that it exists and they may give us a manufacturers part number but this does not tell us what item under that part number is actually being used. How do we rationalize this situation?
MR. GRIMES	I do not think there is any real good answer because in many cases, we do not have the complete data. If it is a Type I identification, it is supposed to have been described either by specifications or drawings of the government, but this is not always necessarily so. Even if it is so, it could be only a performance specification and every make could be a little bit different. I am afraid we are a long way from the answer to your question really. It becomes important. We do not deny this and we know we have a problem but finding the answer for it is something else again. We are trying to get a better interchange of data. I think

MR. GRIMES (Continued) — some of the people have mentioned the EDRS System that was under pilot test and there has been a number of other systems under pilot test which will permit exchange of known specifications, drawings, purchase descriptions, and what have you. But, it is going to be a good many years before this really covers the waterfront enough to be of more than a partial answer to the problem.

QUESTION — Really what I am asking is does DLSC assign a stock number without adequate documentation to make that assignment?

MR. GRIMES — This question cannot be answered yes or no; it depends on the use. To serve the present DLSC use, the answer is no. To serve as a design item, the answer is yes. I think under the DLSC long range plan they will eventually get this licked but it seems sometimes like it is almost hopeless. If they get all the documentation that they are contemplating asking for there should be no question.

QUESTION — If a prime desires to change a CEI specification prior to CDR does the SPO approve the ECP before the prime authorizes the subcontractor to incorporate that change?

COL. MASON — The CDR does not have anything to do with it.

QUESTION — Well, I want it to have something to do with it for this question because we have a case at hand right now where we have had two changes to Part I of a CEI specification with instruction to implement that change on an ECP and the prime never asked us for any impact type comments for us to implement the change. My question is how can they do that thru the SPO, how would you allow them to carry on in that fashion?

COL. MASON — I do not know that I understand the question. The CDR I say has nothing to do with it. If you are talking about a change to Part I of a specification, the performance part, the timing is prior to FACI not CDR. If you are talking about Part II or the detail design, the engineering drawing change, then it is post FACI. The timing is not CDR on this question, I am not sure that I understand.

QUESTION — For simplicity let us take CDR out and say it is FACI then. The CEI specification, Part I, I presume is approved by the SPO before the acquisition contract is let to a subcontractor.

COL. MASON That is right and you could identify other CEI's during development.

QUESTION If the prime, who we are contracted to, instigates a change, a Class I change approved by the SPO, thru the ECP route, and we have a case at hand, they sent this change thru to us to implement without asking us what it is going to do to our schedule, what it is going to do to costs, what it is going to do to support requirements. How do they get away with that with you people looking on?

COL. MASON This is out of our hands, you have to talk to your prime.

QUESTION Is the SPO in the loop for that ECP?

COL. MASON The requirement is that the prime effectively place the same requirements of configuration management on his subs.

QUESTION Should they have our impact comments to get approvals?

COL. MASON Certainly, I would think so and if they do not, I think you should complain.

QUESTION Paragraph 6.1.2 of Exhibit X states that when the CEI of a contractor incorporates the design of a government agency or the design of a subcontractor, the contractor shall use the configuration ident numbers assigned by these design activities without re-identification. We have had primes submit an RFP bid package to us, with CEI number and specification numbers already assigned to equipment that we are going to design. Can we rightfully go back to them and say you cannot do this? 375 does not read this way.

COL. MASON The design activity should assign the number. In your argument with the prime if you have gone to him and have been shot down, I think you could probably go to SPO. Go to the government procuring activity and tell them the prime is not doing it right.

QUESTION With reference to ST prefixes in Exhibit S, is that strictly a prefix to standard documentations or must it also be a prefix to standard part numbers?

COL. MASON It is just the documentation, not for standard part numbers.

QUESTION Exhibit X in reference to CEI numbers, Paragraph 6.3.1f, says all Class I engineering changes shall be approved for production and/or retrofit incorporation in all unexpended units within a mission design series. Or if limited to incorporation on some but not all units the series designations of the affected unit shall be changed to establish a new series letter. What is the relationship of that paragraph to Paragraph 6.3.2.5 which says you need a new top drawing, new specification and new acceptance base to go to a new series letter? In other words, must all those three apply before you can go from A to B on this condition, or can this occur independent of those three requirements?

We conceive that we could have a Class I change which would bring this condition about but it wouldn't necessarily have a new specification, top drawing and new acceptance base which means according to this we do not change the series letter. Could this happen? We thought it was a little nebulous in that area and the final decision we reached is that the only time we are going to change a series letter is when we have a new specification, top drawing, and acceptance base as a result of a change but this paragraph made us consider that it could happen by virtue of the other condition.

COL. MASON I cannot give an intelligent answer on that. I will get you an answer.

QUESTION Where it explains when to go to a new series letter, we interpret this to mean that you could have a non-interchangeable change which would not have a resulting new specification, top drawing and acceptance base. If those three are the criteria to go to a new series letter we could have non-interchangeable configurations within the same series letter. It is therefore our understanding that there can be non-interchangeable configurations within a group of CEI's which are identified by the same CEI number. Is this correct?

COL. MASON This is related to the last question and I will send you an answer to this also.

QUESTION With family designation numbers, when they say it shall not exceed 13, is this 13 beyond the 15 character part number?

COL. MASON No, it is part of the part number, it is within.

QUESTION Under the control portion it says you need the SCN with each ECP. Now if the ECP does not effect the specification, is it true that you nevertheless have to submit the SCN to tell them it does not effect the specification, since 375 says that you need an SCN for every ECP?

COL. MASON If it does not effect the specification, what purpose would it serve? I cannot imagine the need for it. I think that paragraph refers to the development phase. Obviously, the only thing you can refer to is the specification. If it is a Class I change during the post product baseline, it must effect the specification.

QUESTION Requirement for CEI serial numbers is that they begin with one and run in numerical sequence. Does numerical sequence mean consecutive numerical sequence, in other words, 1, 2, 3, 4, 5, or can it be 2, 3, 7, 8, 9? We would have a time at our plant if we had to stick with consecutive numerical sequence and as 375 says itself, you might want to inject spare orders right in the middle of a program or some other contract.

COL. MASON I do not believe that it specifies they must be consecutive sequence, however, if I were going to serialize my units I would number 1, 2, 3, and up, there would be no in-between.

QUESTION We are confused by the AFSCM 375-1 requirement that contract end item (CEI) serials must be numbered "one and subsequent". In our case where we have four different customers with four different contracts for the same piece of equipment, what then?

COL. MASON The contract must specify where to start the contracts box of serials. In other words, you already have one contractor that builds serial numbers 1 thru 100. He has to specify that you number his 101 and up.

MR. SNODGRASS If it is agreed that the part number defines the desired configuration, it should not make any difference which serial number is delivered, as long as you know which one was delivered on a specific contract, and maintain an adequate traceability record.

QUESTION — If a contractor does not change part numbers up the documentation tree above the level of interchangeability, he must serialize changes at his top item, is that not so?

MR. SNODGRASS — A contractor might have different configurations at the detail subassembly level and still retain the same final assembly part number. You must be able to define for your customer which serial number you delivered and the configuration he will have to logistically support. There is a difference between directed effectivity and traceability.

QUESTION — Yes, but if we have these four contracts for one box we can have ten different internal configurations for the same part number for that box, by virtue of the fact that the changes which created the lower level non-interchangeable configurations never went all the way up to the black box level. This may create a situation where we produce ten units for customer X, the next twenty units for customer Y that are a different configuration down inside, and then we produce additional units for customer X again. How does customer X determine spare parts requirements?

MR. SNODGRASS — Your customer must depend upon your internal configuration traceability records that you supply him at the time of delivery. We have had considerable discussion with the Air Force on this subject. The only solution I can recommend is that you clearly define your agreement in your contract. I will see what I can do about including some clarifying charts in the minutes of this Question and Answer period.

The subject of the above led to a discussion centered around the charts which are attached. These charts were prepared by a division of Lockheed Aircraft Corporation in a similar discussion with the Air Force.

Chart #1 contains various quotes taken directly from Exhibits of AFSCM 375-1. These quotes deal directly with change direction requirements and certain specific requirements with respect to numbers which are used for Configuration Management.

Chart #2 depicts the configuration numbers which may be used by contractors for formally and precisely identifying configuration. This also is a direct quote from AFSCM 375-1.

MR. SNODGRASS (Continued)

Based on those two charts, Chart #3 depicts the problem that was facing Lockheed. Namely, how is any contractor to accomplish the tie from the directed level of change to the actual level of change in order to insure that the manufacturing or procurement organizations have no misunderstanding of that which is required. This direction to the shop must be clear, precise, and allow for absolutely no possibility of mis-interpretation.

Chart #4 then investigated the numbers that could be used as specified in Chart #2 for possible application to do the job described. The conclusion reached on this chart is that the only item which can be used, based on the limitations of Chart #1, is the serial number. However, in order to insure that there is no possibility for misinterpretation as to what happens where, the only methods that it can be accomplished by are those which are listed on Charts #4 and #5.

Chart #5 was withheld from the discussion until considerable conversation ensued over the first four charts. After it was agreed that the two solutions shown on Chart #4 were the only possible solutions, Chart #5 was presented which effectively recommends that lower level serialized units be treated as if they were CEI's in the last solution on Chart #4, but without actually accomplishing all of the administrative load required for CEI's. The recommended solution allows directed changes to the lower serialized level and proof of compliance at that lower serialized level regardless of where each individual lower serialized unit might wind up with in respect to the CEI serial numbers. Traceability, however, would be maintained.

The first solution shown on Chart #4 was thrown out unanimously as being an un-economical solution to the problem. The second solution shown on Chart #4 and that solution shown on Chart #5 came in for considerable discussion with the result that both will work and it is up to the individual Air Force Program Office as to which specific method they would choose to accomplish the job. The particular Air Force Program Office recommended that the CEI level be lowered to some point of mutual agreement to allow the ability to direct changes without tumbling part numbers to a high level. However, it was agreed by those same individuals that part numbers would have to tumble (re-identification) up to the level of (but not necessarily including) the first CEI.

MR. SNODGRASS (Continued)

No one in the meeting was able to offer any other solution to the problem shown on Chart #3, so that agreement was reached that these are the only possible solutions. It should be recognized that if this is true for directing and tracing of Class I changes, which was the subject of the discussion, it is also true for directing and tracing Class II changes. Any change that needs to be directed to specific serials will involve this same analysis.

A F S C / L O C K H E E D

CONFIGURATION

MANAGEMENT

DISCUSSION

AIR FORCE REQUIREMENTS

- THE CONTRACT END ITEM NUMBER (CEI) IS USED TO IDENTIFY THE LEVEL AT WHICH TECHNICAL AND CONTRACTUAL REQUIREMENTS SHALL BE MANAGED
  AFSCM 375-1, Exhibit X, Table A
- THE CEI SERIAL NUMBER SHALL BE THE ENGINEERING EFFECTIVITY TO WHICH ALL MANAGEMENT ACTIONS ARE SPECIFICALLY ADDRESSED.
  AFSCM 375-1, Exhibit X, Table A
- THE PART NUMBER SHALL BE CHANGED ONLY UP TO AND INCLUDING THE ASSEMBLY WHERE INTERCHANGEABILITY IS RE-ESTABLISHED.
  AFSCM 375-1, Exhibit X, 6.5.2.5.
- PRODUCTION CONTROLS ARE ESTABLISHED TO PROPERLY ROUTE VENDOR ITEMS AND SUBASSEMBLIES CONTAINING ENGINEERING CHANGES TO THE CONTRACT END ITEMS ON WHICH THESE ENGINEERING CHANGES ARE TO BE INSTALLED AS REQUIRED BY RELEASED ENGINEERING DATA.
  AFSCM 375-1, Exhibit XIII, 6.2.5.
- PART NUMBER IDENTIFICATION ALONE WILL NOT VERIFY THAT A CHANGE HAS BEEN INCORPORATED. AFSCM 375-1, Exhibit XIII, 6.4.2.

CONFIGURATION NUMBERS

- THE NUMBERS ASSIGNED BY CONTRACTORS ARE:
  - SPECIFICATION IDENTIFICATION NUMBERS
  - CONTRACT END ITEM NUMBERS (CEI)
  - SERIAL NUMBERS
    - CEI
    - FAMILY DESIGNATION
  - DRAWING AND PART NUMBERS
  - CHANGE IDENTIFICATION NUMBERS
  - CODE IDENTIFICATION NUMBERS
- THESE NUMBERS ARE THE ONLY IDENTIFIERS TO BE USED BY CONTRACTORS AND THE PROCURING AGENCY TO FORMALLY AND PRECISELY IDENTIFY CONFIGURATION.

AFSCM 375-1, Exhibit X, 2.0

THE PROBLEM

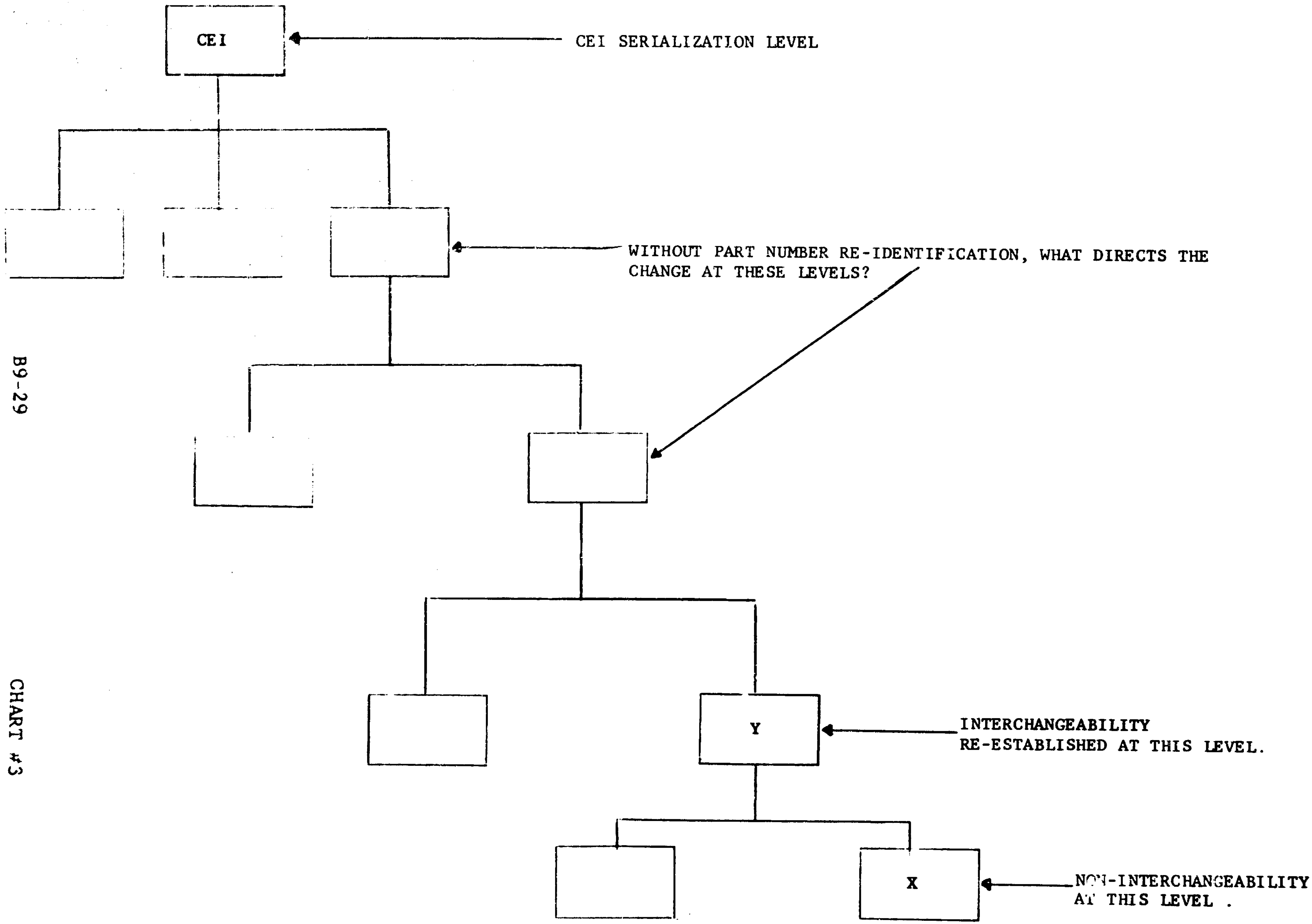


CHART #3

WHAT DIRECTS THE CHANGE AT INTERMEDIATE LEVELS?

- o THE SPECIFICATION NUMBER - USCN's ARE NOT APPLIED TO HARDWARE
- o CONTRACT END ITEM NUMBER - ONLY USED ON CEI LEVEL
- o SERIAL NUMBER ??
- o DRAWING AND PART NUMBERS - FORBIDDEN
- o CHANGE ID NUMBERS - WHICH CHANGE ON WHICH CEI SERIAL
- o CODE ID NUMBERS - SAME FOR ALL HARDWARE

SO

- o ASSIGN SPECIFIC UNIT SERIAL TO SPECIFIC CEI SERIAL APPEARS TO BE ONE SOLUTION

OR

- o LOWER THE CEI LEVEL WHICH IMPOSES GREATER ADMINISTRATIVE LOAD ON THE AIR FORCE.

CHART #4

SOLUTION RECOMMENDED BY LOCKHEED

- PREPARE ECP'S IN TERMS OF CHANGES TO LOWER SERIALIZED LEVELS OF ASSEMBLY (i.e., ALL INDIVIDUALLY SERIALIZED/TESTED COMPONENTS).

- DIRECT THE CHANGE TO SPECIFIC SERIAL NUMBER(s) AND UP AT THE LEVEL OF CHANGE.

- VERIFY CHANGE INCORPORATION AT THE SERIALIZED LEVEL OF CHANGE.

- DD-250 THE CEI IN TERMS OF THE SERIALIZED COMPONENTS IT CONTAINS.

CHART #5

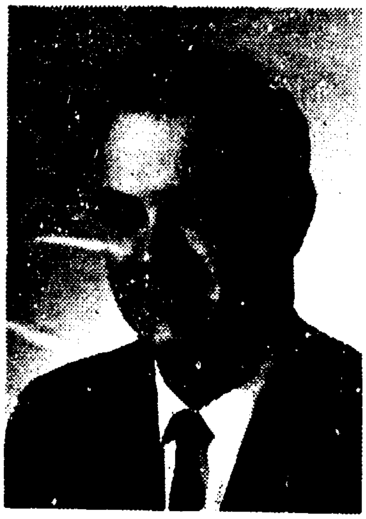
C. THURSDAY MORNING SESSION - APRIL 28, 1966

INTRODUCTION

This section contains the following paper presented on Thursday morning and Scenes at Cape Kennedy; Presiding Chairman, James Kay; Recording Secretary, John H. Jascheck

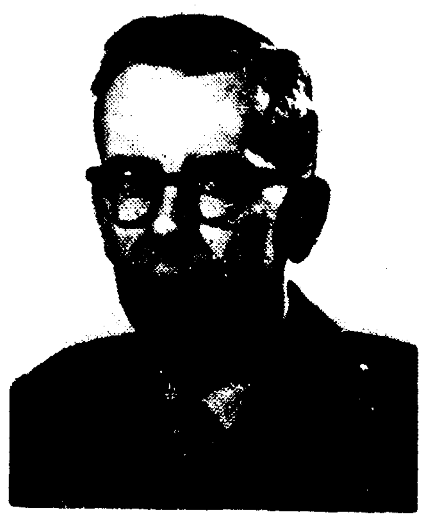
- Configuration Management Requirements for the Apollo Program and How They are Being Implemented at KSC
  by Major Andrew J. Reis

- Scenes at Cape Kennedy



J. R. KAY
PRESIDING CHAIRMAN

J. H. JASCHECK
SECRETARY



MAJOR A. J. REIS, JR.

CONFIGURATION MANAGEMENT REQUIREMENTS FOR THE APOLLO PROGRAM

and

HOW THEY ARE BEING IMPLEMENTED AT KSC

Major Andrew J. Reis

29 April 1966

Presented

at the

Eighth Annual Meeting

Engineering Documentation Section

AMERICAN ORDNANCE ASSOCIATION

CONFIGURATION MANAGEMENT REQUIREMENTS FOR THE APOLLO PROGRAM

and

HOW THEY ARE BEING IMPLEMENTED AT KSC

On behalf of the Director, let me take this opportunity to welcome members of the American Ordnance Association to Kennedy Space Center. From my point of view, I am not certain that having this presentation located at KSC, rather than Daytona Beach, is proper. Since, by the common definition, I am no longer an expert at the subject under discussion. Although I am not 50 miles from home, I do happen to have a briefcase containing a few vu-graphs and some notes. As an introduction into the subject at hand, I have selected a few pictures to give you a tourist eye-view of some of the "end items" of hardware for which KSC is Design/Development responsible. These items you will see later in the morning during your bus tour of the Center.

These few slides were selected only to give you some feel for the magnitude of the overall Apollo Program, and in turn, to recognize that the Kennedy Space Center has a considerable Design/Development responsibility in addition to their functions of Site Activation and Launch Operations. Incidently, my presentation today will concern itself only with KSC's function of Design/Development.

It was easy to prepare the first part of this presentation, Configuration Management requirements on the Apollo Program; however, the second part, implementation within the Kennedy Space Center, is a little more difficult. The Apollo Program has a Configuration Management Manual, NPC 500-1, which contains requirements which are quite similar to AFSCM 375-1. This manual, NPC 500-1, the Apollo Program Development Plan (APDP) and some supporting Directives contain the Configuration Management requirements for the Apollo

Program. Very basically stated, Configuration Management requires that requirements be identified on paper and that paper identifies the hardware developed. So, I can say that the Configuration Management requirements of the Apollo Program simply stated requires paper, identified and under control, in proper form to identify the equipment, operate it and maintain it.

(Use LUT - Paper Slide No. 1)

The imposition of NPC 500-1 in 1964, long after the Apollo Program had started, meant that the Program had far advanced without standardization imposed upon the many agencies. Much paper existed but not necessarily in the form required. The handling of this paper created many deep grooves or ruts all headed in directions similar to the spokes of a bicycle wheel. To fulfill the immediate intent of NPC 500-1, one would have had to use a giant plow, forcefully cover all radial grooves, and then lay a four-lane highway to Utopia. I am sorry to say that many grooves still exist, but plans for a freeway have been completed and construction is underway.

One major problem, as you well know, is that the state of the art for landing on the moon was not, and still is not, very far advanced. Change was, and still is, the order of the day. Change far outran the development of paper -- if paper, proper paper was actually developed? The total volume of paper and change may never be determined. The compatibility of the equipment and paper is, of course, in doubt because standardization did not exist, and control, as envisioned by NPC 500-1, was not present. The scientists and Designers knew what change was needed but validation of change incorporation was not necessarily coordinated. The operators knew what had to be changed for proper operation and so made the necessary change for a test. The problem here was that Identification and re-Identification was not standardized, formal control was not necessarily present, and accounting made no attempt to keep all, and I mean all, personnel informed of the Configuration as it existed at any point in time.

So much for the basic problems.

Configuration Management, as defined in NPC 500-1, really started at KSC in November of 1964. Col. Petrone, the KSC Apollo Program Director, established a Configuration Management Office, under my technical direction, within the purview of the Program Control Office. By that time, much equipment and facilities were already available at the Cape, many Design Contractor's tasks completed, and Operation and Maintainance Contractors assigned operational and maintainance responsibilities.

No attempt had been made to standardize paper or develop a program as stated in NPC 500-1. Paper did exist but standardization of formats and contents were poor. In the event that some of you may be thinking NASA, or the Apollo Program, is the only Program where lack of standardization occurred. Think back, less than 4 years ago.

All of you in this auditorium remember the hue and cry which arose from all Contractors when the Air Force imposed AFSCM 375-1 upon them. Probably some of you wrote some of the comments contained in the AOA study on the subject. The gist of the comments were - too much Government control. Well, the Program Office within KSC has received similar comments from NASA Design Agencies, - too much Program Office control. But NPC 500-1 has been imposed and we intend to have Configuration Management at KSC.

Specifications, as defined in NPC 500-1 (also in 375-1), just aren't available.

Performance/Design Requirements and Product Configuration Requirements obviously exist or else what one sees on the launch pads are only an hallucination. Contract End Items are located there but weren't identified as such.

The solution, of course, was to start with a total Configuration Management Plan which would make data available for identification, place that data under control and account for it in such a way that all knew what the status was at any time.

The KSC Configuration Management Plan (K-AM-03) was in preparation for too long a time, but was actually published in January 1966. Some of its contents and instructions were in effect before its publication however, in that many of the procedures called out in the plan had been completed and levied on Agencies and Contractors. The plan is simply the development of a system similar to that described in the AFSCM 375 series of documents. As I stated before, most of the equipment and facilities are here, so obviously variations are permitted.

As I mentioned earlier, Specifications, as required by NPC 500-1, just aren't available. Performance/Design requirements do exist but are not collected as yet into an overall System Specification Tree, showing the total relationship of all end items.

One reason for this state of affairs was the late issue of the Apollo Program Specifications. Equipment was designed, developed and produced without the firm guidelines this document could have provided. Even today this document is incomplete. The family of specifications called for therein do not exist in the desired forms and thus, there is no guarantee of compatibility for CEI to Program.

KSC recognized this problem area, conducted a most gross analysis, identified systems and prime CEI's, and prepared a KSC Top Level Specification Tree. A

Program Directive has been issued requiring NASA Agencies to complete the Specification Tree to Low Level requirements and to prepare the necessary supporting specifications. NASA Design Agencies are now working to this Directive. However, much still remains to be done in this area before we can feel confident that all of our requirements are identified and complied with.

(Show Specification Tree No. 2)

The number of drafting systems at KSC almost equal the number of organizations. No attempt had been made, in the past, to standardize systems in accordance with known standards. Every drawing and every document has been prepared and controlled in a different manner. Traceability and Identification of parts is difficult. Re-Identification of parts does not always occur if change affects form, fit or functions. To solve this problem, a KSC Standard Drafting Manual has been issued for all Class I drawings. Recent Class II drawings have been I.A.W. 500-1. We will not attempt to convert all documents to the proper standards immediately, the cost would be prohibitive at present. A slow phase-in is being planned, perhaps 10% per year. However, all new designs and major changes in present designs will be supported only by proper data.

Concurrently with the conduct of a gross analysis and Specification Tree development, a plan was developed which would establish reviews by which equipment and facilities would be compared to existing data, regardless of the form in which the data existed. We have called these reviews FACI's. At the time these reviews started, we had only identified equipment and facilities to the System Level, so we FACIed Systems. These reviews have not been completely successful in establishing Product Configuration Baselines because generally, proper data is not available. But they have been eminently successful in identifying to many people that real problems exist, and as a result, other people are now trying to correct their problems. The FACI's have been an excellent training vehicle. Without them, I doubt if we could have made much of an impression as to the aims of Configuration Management. This Center has been conducting approximately one system FACI a day. The reaction to our FACI reports give us a sense of accomplishment, even though we know that much more must be done before we can say our job is completed. Basically, all we have accomplished is the channeling of thought along the lines required by NPC 500-1 in regard to that data needed for Identification, Control and Accounting. The accomplishment of another series of FACI's at the CEI level, will depend entirely upon the availability of data and schedule problems. To date, we have conducted system FACI's on all priority I, LC-34 systems, a few on LC-37 systems, and we have just begun on LC-39. It has been, and remains, an immense task which is being accomplished.

The change control area is the most difficult to discuss with groups not intimately concerned with KSC operations. The immensity of the operations here is beyond belief.

The turbulent growth which is taking place here defies any immediate imposition of control. But control is vitally needed. Equipment, spares, and parts arrive continuously and are channeled somewhere. Buildings bloom continuously. All of this in the atmosphere of change. And, as you have already surmised, paper or data, as required by NPC 500-1, is just not available, at present, in proper form or content to make proper evaluation of requested changes or insure system-wide implementation of approved changes.

A cautious or prudent Center would have waited until some of the smoke cleared away before establishing Configuration Control Boards. But, equipment and buildings were undergoing operational tests and change was necessary. Here I rush to say that changes were under some type of control. They had to be because changes cost and money had to be allocated before change occurred. Evaluation of changes was generally conducted only by the individual desiring the change, and as we all know, this is tantamount to saying that all changes are automatically mandatory. No designer would submit a change unless he approved it. Tracking the change was impossible because there were no formal procedures to make sure that the change had been recognized, approved, and steps taken to implement it systems-wide. Validation of change incorporation normally waited until a test was conducted to prove proper configuration. So many people worked on equipments, each making his desired change, that no one could possibly say what the configuration was. Re-identification did not necessarily occur.

It was not easy to establish CCB's. As usual, everyone thought the CCB's would control design and no designer wanted that. The number of meetings held to indoctrinate personnel cannot be counted. But common sense prevailed and CCB's were established.

(Flash chart showing CCB structure No. 3)

One can see that this structure is not that envisioned by NPC 500-1. The levels of decision-making are multiple. The Program is so large and changes are so numerous that it is an impossibility for any one CCB to handle requirements. The assignment of decreasing criteria to each lower level CCB does, of course, create control at those levels.

I would like to state that we have control, but I can not make that statement. The CCB's still cannot make proper evaluation because of lack of paper upon which to base a decision. All baselines are still not formally established, and will not be, until we have Specifications and completed the necessary Configuration Audits to insure compatibility between equipment, facilities, and their related data.

Here, again, one might look upon our CCB's, as presently operating, as a training vehicle. The members are becoming familar with the problems involved and are, themselves, taking the necessary steps to improve evaluations.

The use of Configuration Control Board Directives is forcing all members to take a long hard look at the necessity to evaluate changes system-wide to insure that change impacts are recognized, accepted and corrected, if correction is necessary.

The Accounting requirements called for in NPC 500-1 are being met by using the Program developed by the Air Force for AFSCM 375-1. The reason for this is that a machine program was available from the Air Force, which we were fortunate in obtaining.

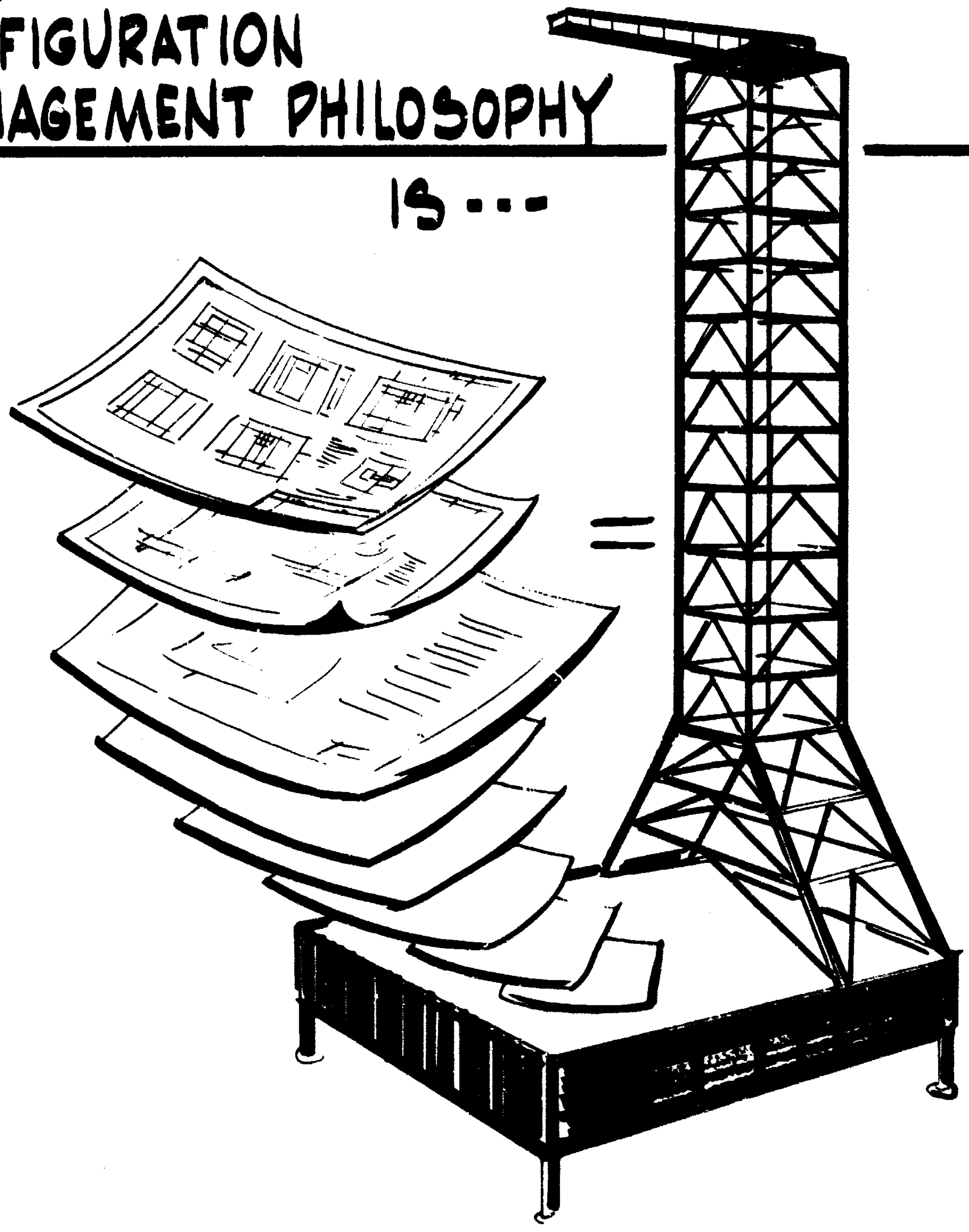
However, as you well know, similar nomenclature in computers does not guarantee similarity of Configuration. We had considerable re-programming effort to accomplish. As of just recently, the Computer Program is operational, and we have been loading the machines with information obtained from the FACI's conducted and Change Board actions taken. Our first printout occurred yesterday for LC-37.

Let me say a few words regarding Interfaces. There have been approximately 180 Interface Documents identified with MSFC and MSC. These Interface Control Documents are separated by Complex (LC-34, LC-37 and LC-39), and listed in a document by Launch Flight effectivity. If you recognize that KSC's primary development function is Facilities and GSE, and recognizing that Design requirements for Facilities and GSE are normally identified after flight hardware, then you can readily anticipate that these ICD's were late being identified. However, over the past year, a major effort resulted in the identification and release of all ICD's -- major KSC design requirements. We have inter=Center agreements with the other Centers for the control of changes to these ICD's. This, obviously, does not mean there are no changes to ICD's, but only that we have agreements to assure that the Centers involved with a change are aware of, concur with the necessity for a change, and jointly implement the change.

In conclusion, let me state that Configuration Management just as in your organizations, was slow arriving, painful in initiation, but is here to stay at KSC. Thank you for your attention......

KSC CONFIGURATION MANAGEMENT PHILOSOPHY

IS . . .



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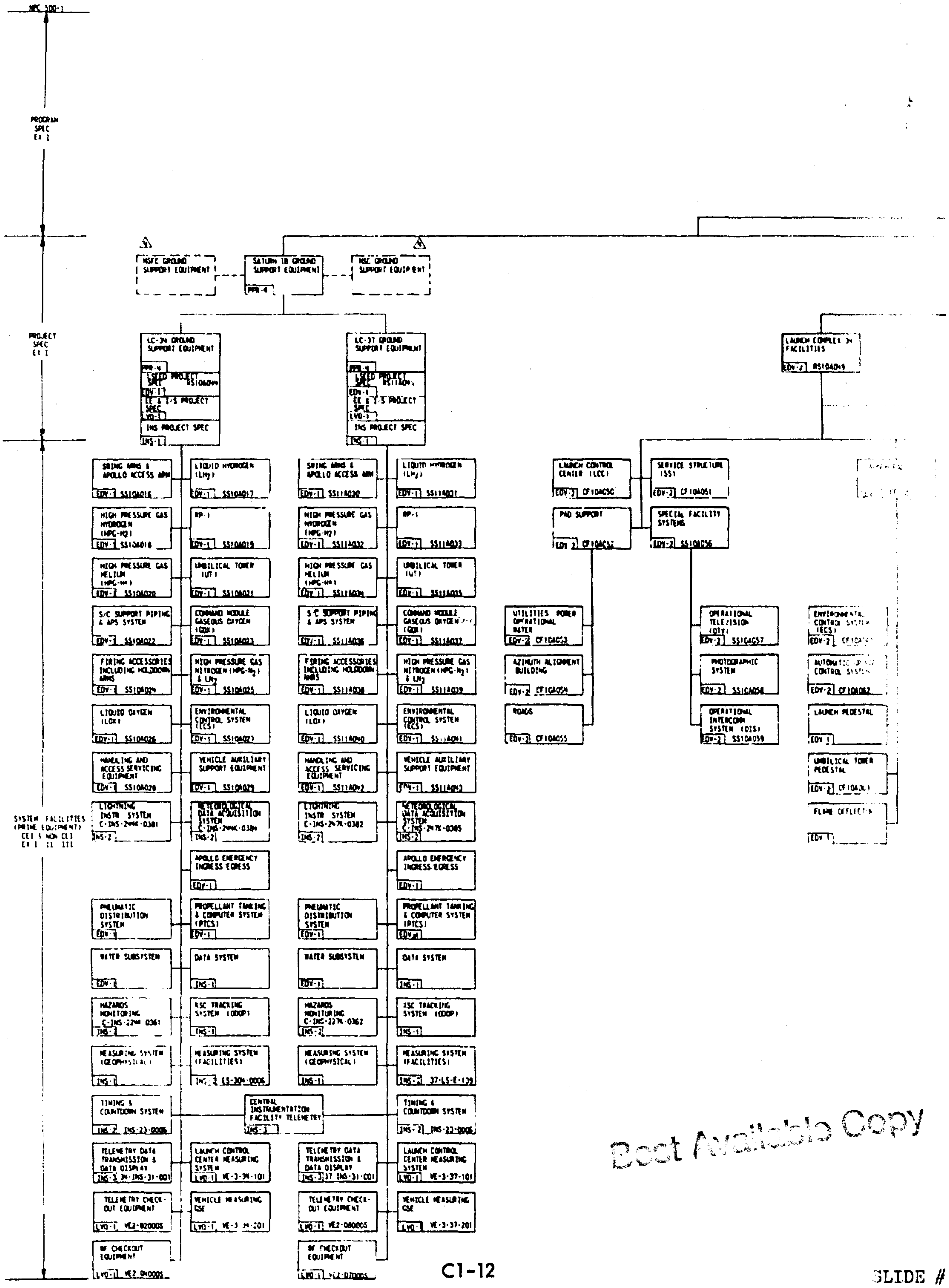

C1-12

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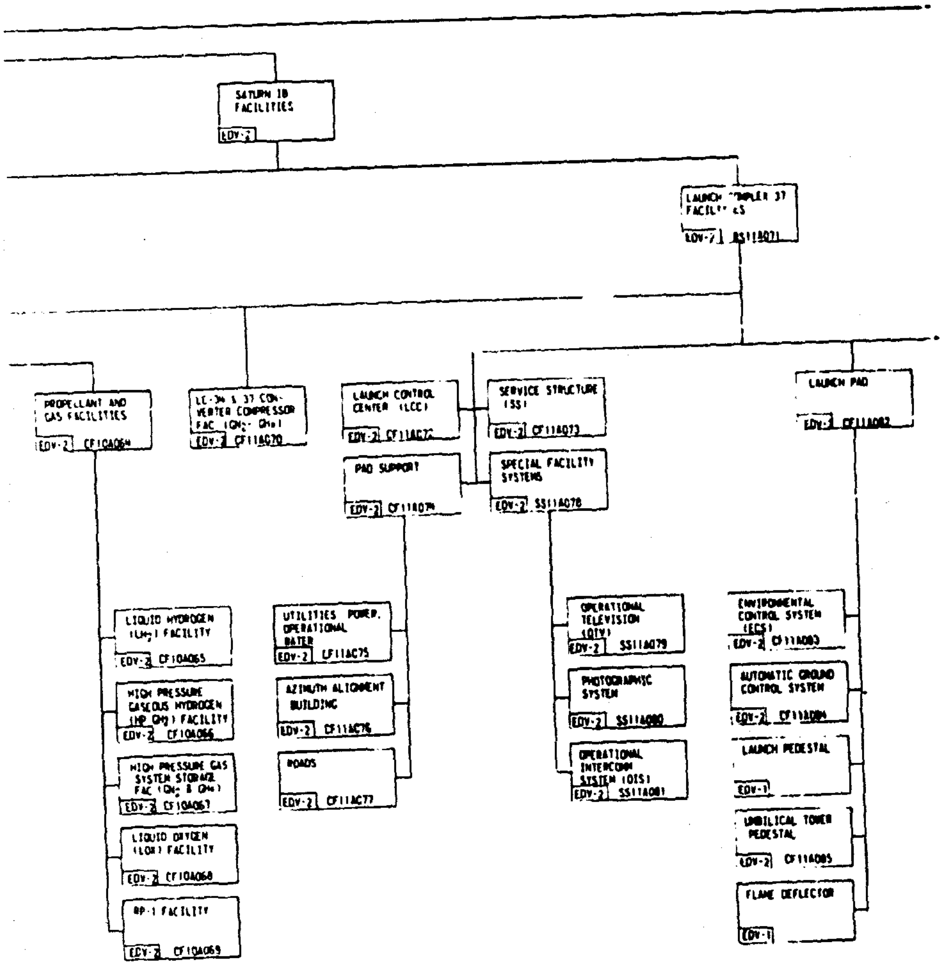
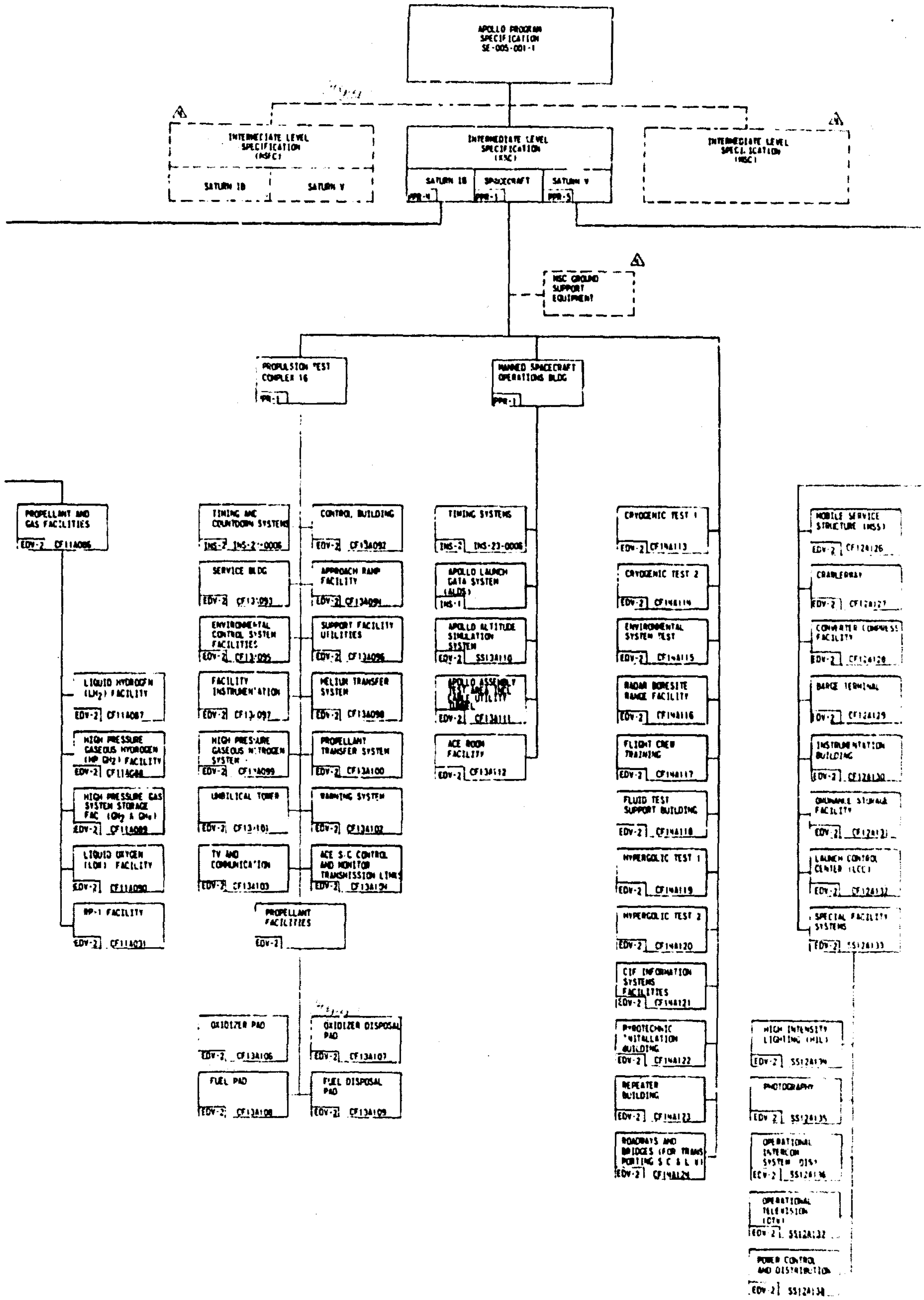
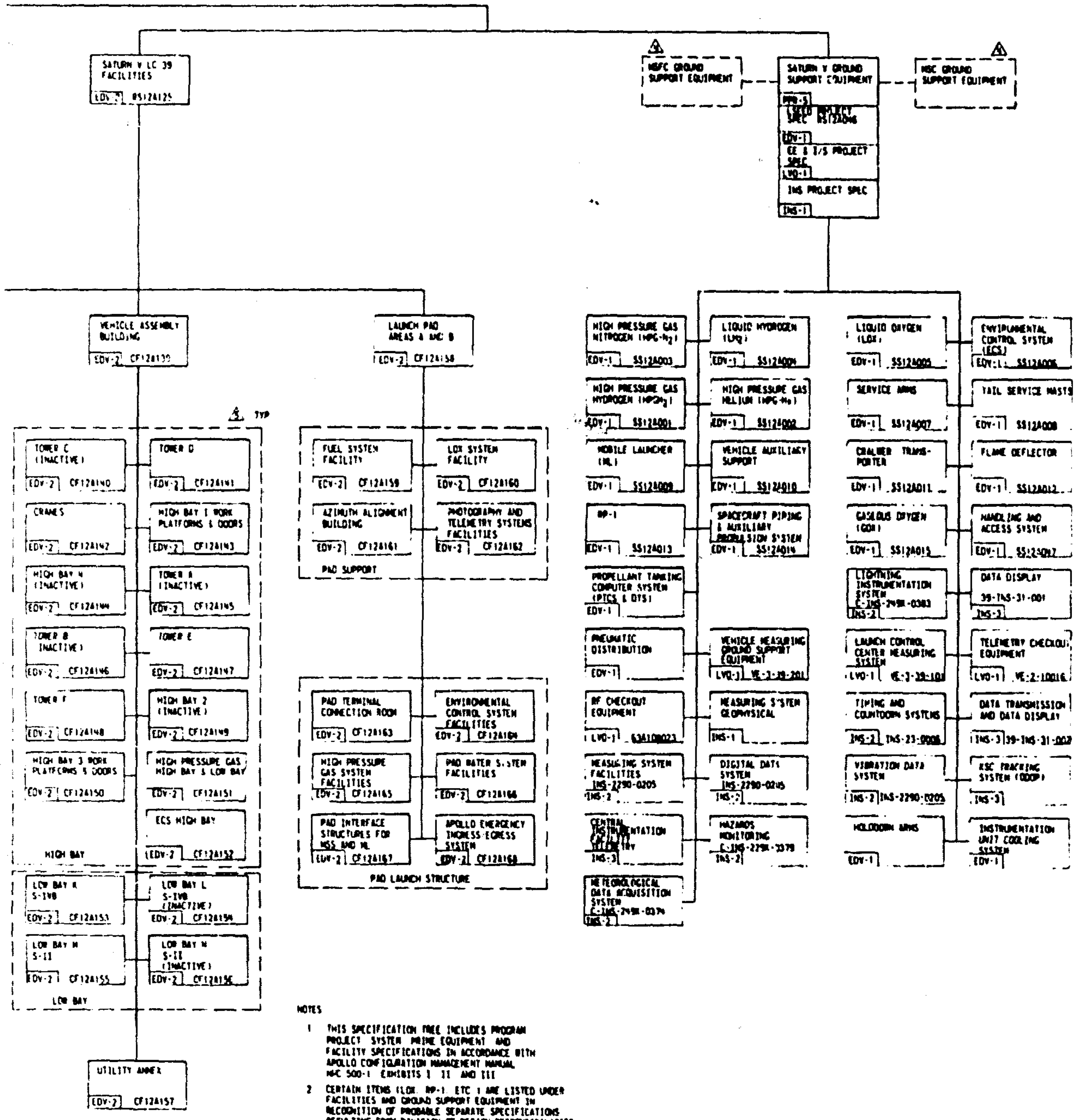

SATURN IB FACILITIES
EDV-2
PROPELLANT AND GAS FACILITIES
EDV-2 CF10A064
LC-34 & 37 CONVERTER COMPRESSOR FAC
EDV-2 CF11AC70
LAUNCH CONTROL CENTER (LCC)
EDV-2
PAD SUPPORT
EDV-2 CF11A074
SERVICE STRUCTURE (SS)
EDV-2 CF11A073
SPECIAL FACILITY SYSTEMS
EDV-2 SS11A078
LAUNCH PAD
LIQUID HYDROGEN (LH2) FACILITY
EDV-2 CF10A065
HIGH PRESSURE GASEOUS HYDROGEN (HP GH2) FACILITY
EDV-2 CF10A066
HIGH PRESSURE GAS SYSTEM STORAGE FAC
EDV-2 CF10A067
LIQUID OXYGEN (LOX) FACILITY
EDV-2 CF10A068
RP-1 FACILITY
EDV-2 CF10A069
UTILITIES POWER, OPERATIONAL WATER
EDV-2 CF11AC75
AZIMUTH ALIGNMENT BUILDING
EDV-2 CF11AC76
ROADS
EDV-2 CF11AC77
OPERATIONAL TELEVISION (OTV)
EDV-2 SS11A079
PHOTOGRAPHIC SYSTEM
EDV-2 SS11A080
OPERATIONAL INTERCOM SYSTEM (OIS)
EDV-2 SS11A081
ENVIRONMENTAL CONTROL SYSTEM (ECS)
EDV-2 CF11A083
AUTOMATIC GROUND CONTROL SYSTEM
EDV-2 CF11A084
LAUNCH PEDESTAL
EDV-1
UMBILICAL TOWER PEDESTAL
EDV-2 CF11A085
FLAME DEFLECTOR
EDV-1

SLIDE


APOLLO PROGRAM SPECIFICATION SE-005-001-1
INTERMEDIATE LEVEL SPECIFICATION (MSFC)
SATURN IB
SATURN V
INTERMEDIATE LEVEL SPECIFICATION (KSC)
SATURN IB
SPACECRAFT
SATURN V
PPR-4
PPR-1
PPR-5
INTERMEDIATE LEVEL SPECIFICATION (MSC)
MSC GROUND SUPPORT EQUIPMENT
PROPULSION TEST COMPLEX 16
PPR-1
MANNED SPACECRAFT OPERATIONS BLDG
PPR-1
PROPELLANT AND GAS FACILITIES
EDV-2 CF11A086
LIQUID HYDROGEN (LH2) FACILITY
EDV-2 CF11A087
HIGH PRESSURE GASEOUS HYDROGEN (HP GH2) FACILITY
EDV-2 CF11A088
HIGH PRESSURE GAS SYSTEM STORAGE FAC (GN2 & GHe)
EDV-2 CF11A089
LIQUID OXYGEN (LOX) FACILITY
EDV-2 CF11A090
RP-1 FACILITY
EDV-2 CF11A031
TIMING AND COUNTDOWN SYSTEMS
INS-2 INS-2-0006
SERVICE BLDG
EDV-2 CF13A093
ENVIRONMENTAL CONTROL SYSTEM FACILITIES
EDV-2 CF13A095
FACILITY INSTRUMENTATION
EDV-2 CF13A097
HIGH PRESSURE GASEOUS NITROGEN SYSTEM
EDV-2 CF13A099
UMBILICAL TOWER
EDV-2 CF13A101
TV AND COMMUNICATION
EDV-2 CF13A103
CONTROL BUILDING
EDV-2 CF13A092
APPROACH RAMP FACILITY
EDV-2 CF13A094
SUPPORT FACILITY UTILITIES
EDV-2 CF13A096
HELIUM TRANSFER SYSTEM
EDV-2 CF13A098
PROPELLANT TRANSFER SYSTEM
EDV-2 CF13A100
WARNING SYSTEM
EDV-2 CF13A102
ACE S-C CONTROL AND MONITOR TRANSMISSION LINKS
EDV-2 CF13A104
PROPELLANT FACILITIES
EDV-2
OXIDIZER PAD
EDV-2 CF13A106
FUEL PAD
EDV-2 CF13A108
OXIDIZER DISPOSAL PAD
EDV-2 CF13A107
FUEL DISPOSAL PAD
EDV-2 CF13A109
TIMING SYSTEMS
INS-2 INS-23-0006
APOLLO LAUNCH DATA SYSTEM (ALDS)
INS-1
APOLLO ALTITUDE SIMULATION SYSTEM
EDV-2 SS13A110
APOLLO ASSEMBLY TEST AREA FUEL CABLE UTILITY TUNNEL
EDV-2 CF13A111
ACE ROOM FACILITY
EDV-2 CF13A112
CRYOGENIC TEST 1
EDV-2 CF14A113
CRYOGENIC TEST 2
EDV-2 CF14A114
ENVIRONMENTAL SYSTEM TEST
EDV-2 CF14A115
RADAR BORESITE RANGE FACILITY
EDV-2 CF14A116
FLIGHT CREW TRAINING
EDV-2 CF14A117
FLUID TEST SUPPORT BUILDING
EDV-2 CF14A118
HYPERGOLIC TEST 1
EDV-2 CF14A119
HYPERGOLIC TEST 2
EDV-2 CF14A120
CIF INFORMATION SYSTEMS FACILITIES
EDV-2 CF14A121
PYROTECHNIC INSTALLATION BUILDING
EDV-2 CF14A122
REPEATER BUILDING
EDV-2 CF14A123
ROADWAYS AND BRIDGES (FOR TRANSPORTING S C & L V)
EDV-2 CF14A124
MOBILE SERVICE STRUCTURE (MSS)
EDV-2 CF12A126
CRAWLERWAY
EDV-2 CF12A127
CONVERTER COMPRESSOR FACILITY
EDV-2 CF12A128
BARGE TERMINAL
EDV-2 CF12A129
INSTRUMENTATION BUILDING
EDV-2 CF12A130
ORDNANCE STORAGE FACILITY
EDV-2 CF12A131
LAUNCH CONTROL CENTER (LCC)
EDV-2 CF12A132
SPECIAL FACILITY SYSTEMS
EDV-2 SS12A133
HIGH INTENSITY LIGHTING (HIL)
EDV-2 SS12A134
PHOTOGRAPHY
EDV-2 SS12A135
OPERATIONAL INTERCOM SYSTEM (OIS)
EDV-2 SS12A136
OPERATIONAL TELEVISION (OTV)
EDV-2 SS12A137
POWER CONTROL AND DISTRIBUTION
EDV-2 SS12A138



NOTES

1 THIS SPECIFICATION TREE INCLUDES PROGRAM PROJECT SYSTEM PRIME EQUIPMENT AND FACILITY SPECIFICATIONS IN ACCORDANCE WITH APOLLO CONFIGURATION MANAGEMENT MANUAL NPC 500-1 EXHIBITS I II AND III

2 CERTAIN ITEMS (LOX. RP-1. ETC) ARE LISTED UNDER FACILITIES AND GROUND SUPPORT EQUIPMENT IN RECOGNITION OF PROBABLE SEPARATE SPECIFICATIONS RESULTING FROM DIVISION OF DESIGN RESPONSIBILITIES

3 DOTTED LINE BETWEEN BLOCKS INDICATES A FUNCTIONAL RELATIONSHIP

4 DOTTED BLOCK INDICATES SPECIFICATION IS WRITTEN BY ANOTHER CENTER

5 DOTTED ENCLOSURE INDICATES PHYSICAL AREA

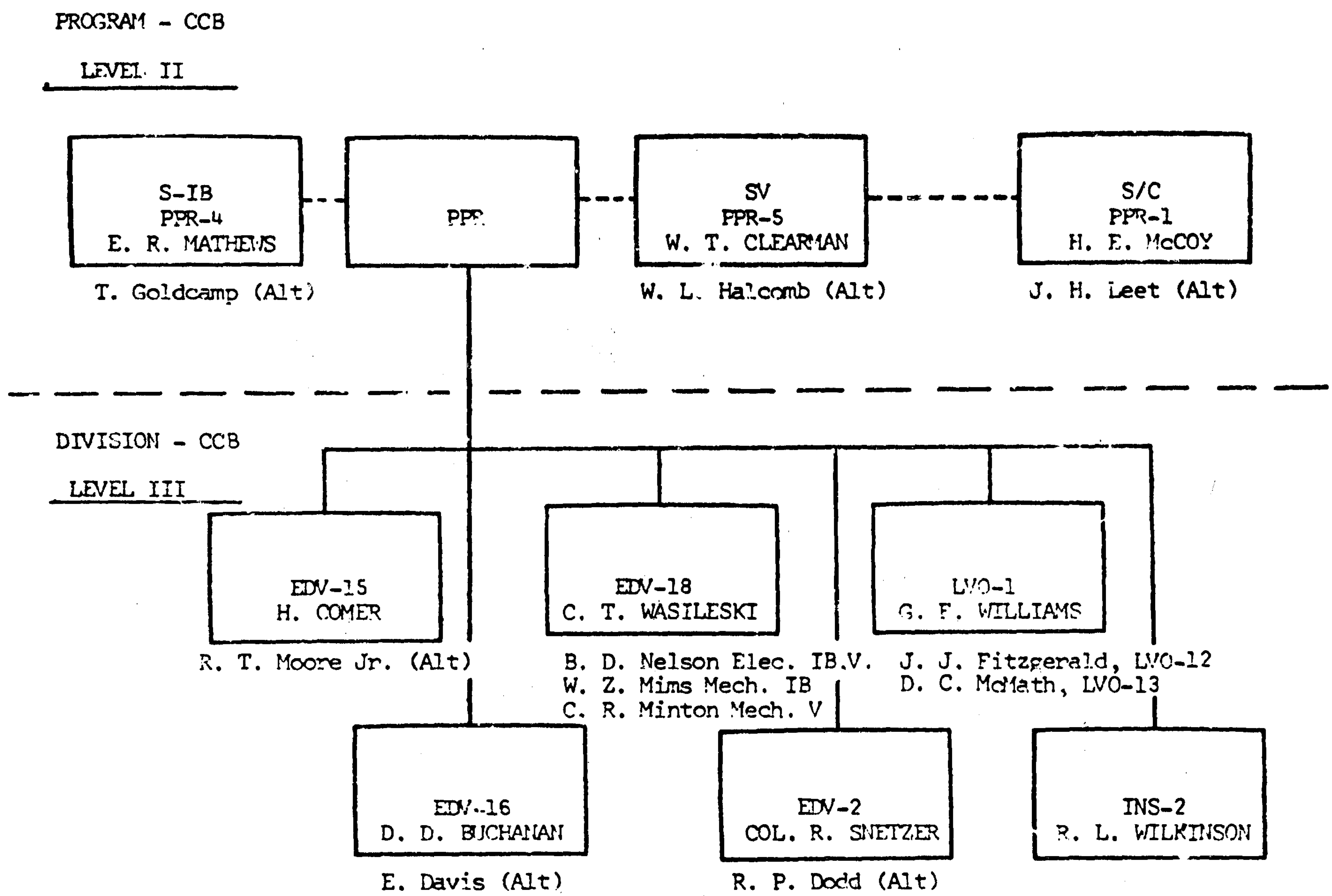
6 THIS TREE IS A COMPILATION OF SPECIFICATION TREES IDENTIFIED AS K-IB-0111 K-IB-0112 AND K-V-0121

KSC APOLLO SATURN
TOP SPECIFICATION TREE
(K-AM-030-1)

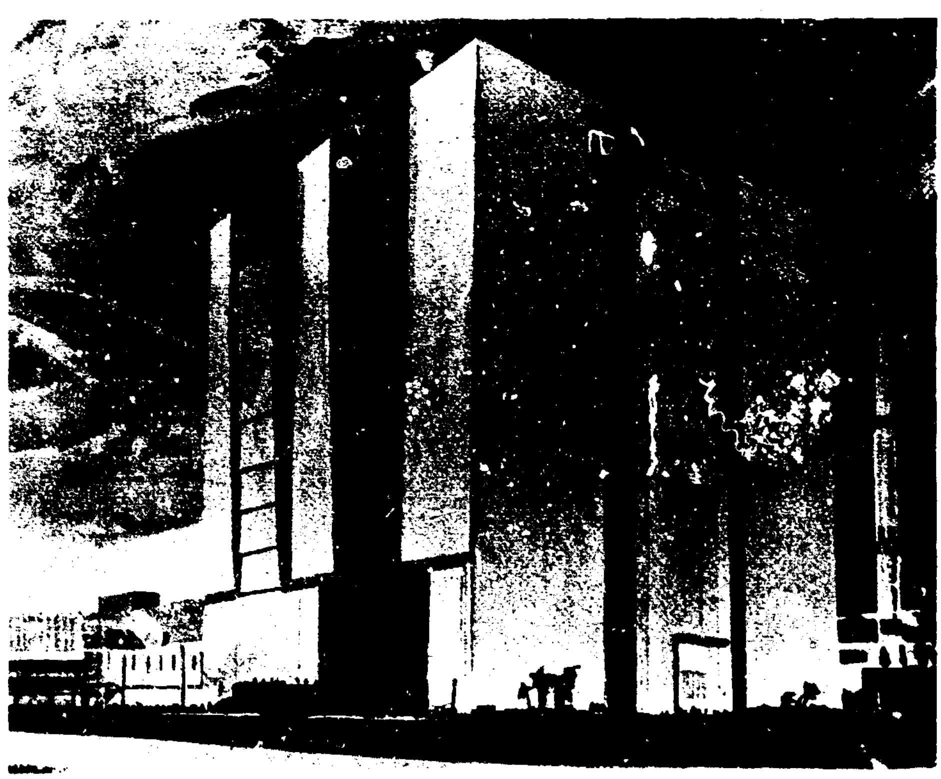
JANUARY 5 1966 (NEW)

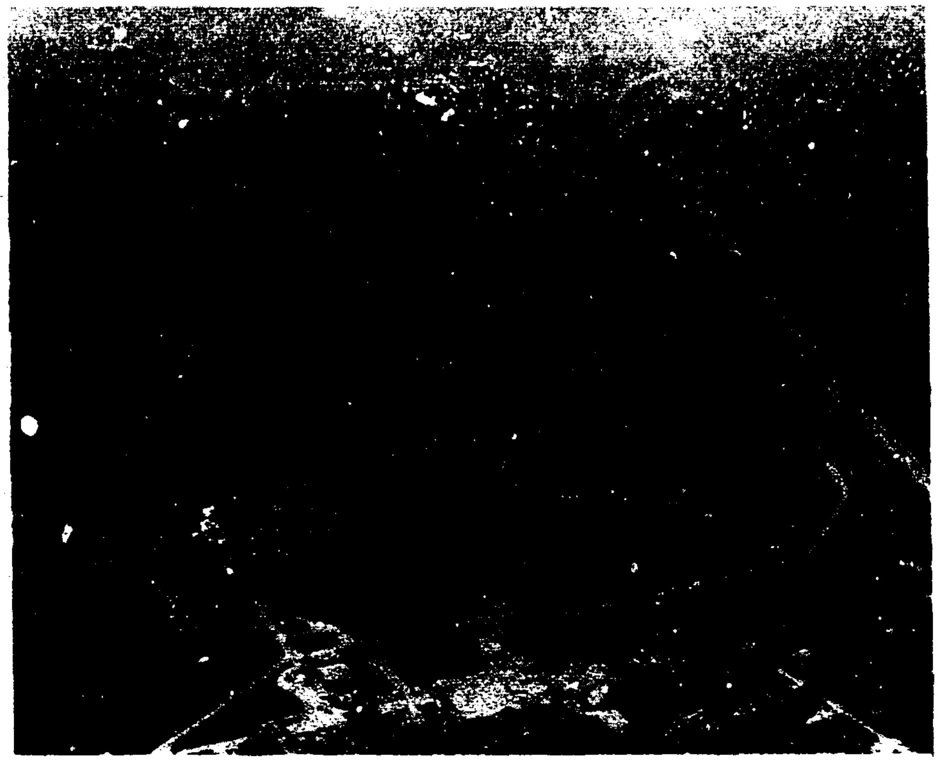
APPROVED BY [signature]
ROCCO A. PETRONE
DIRECTOR PLANS, PROGRAMS & RESOURCES

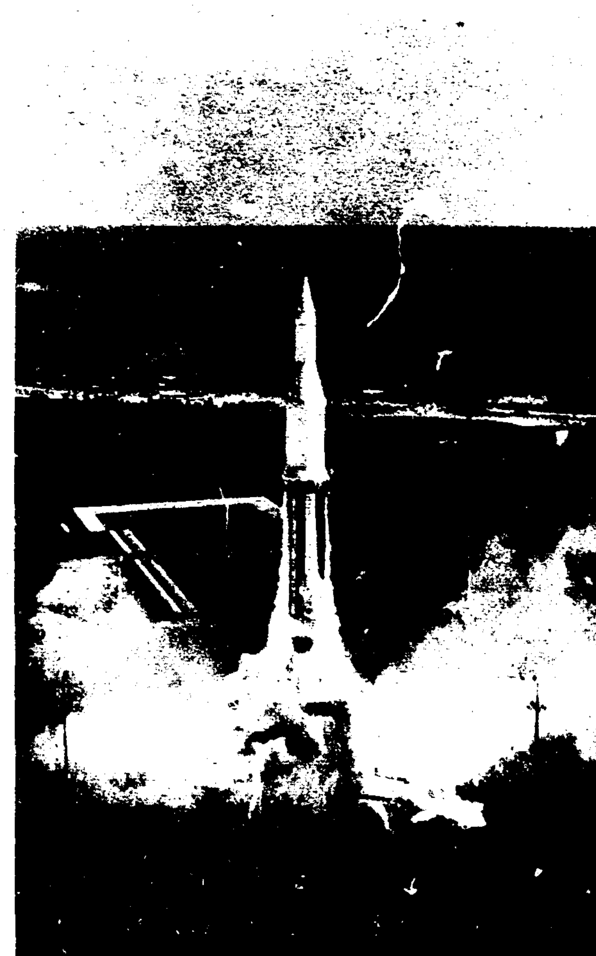
SLIDE #


PROGRAM - CCB
LEVEL II
S-IB
PPR-4
E. R. MATHEWS
T. Goldcamp (Alt)
PPR
SV
PPR-5
W. T. CLEARMAN
W. L. Halcomb (Alt)
S/C
PPR-1
H. E. McCOY
J. H. Leet (Alt)
DIVISION - CCB
LEVEL III
EDV-15
H. COMER
R. T. Moore Jr. (Alt)
EDV-18
C. T. WASILESKI
B. D. Nelson Elec. IB.V.
W. Z. Mims Mech. IB
C. R. Minton Mech. V
LVO-1
G. F. WILLIAMS
J. J. Fitzgerald, LVO-12
D. C. McMath, LVO-13
EDV-16
D. D. BUCHANAN
E. Davis (Alt)
EDV-2
COL. R. SNETZER
R. P. Dodd (Alt)
INS-2
R. L. WILKINSON

SCENES OF CAPE KENNEDY







D. THURSDAY AFTERNOON SESSION - APRIL 28, 1966

INTRODUCTION

This section contains the following papers, reports and panel session presented on Thursday afternoon; Presiding Chairman, Joseph Mazia; Recording Secretary, Burt G. Schaefer.

- Data Management at Marshall Space Flight Center,
  by R. Lamonte Goldston

- The Army Concept & Organization for Technical Data Management,
  by Colonel Charles T. Campbell

- Data Management for Decision Making $(DM)^2$,
  by Lt. Colonel William O. Rennhack

- Systems Management - A Framework for Standardization (Panel 29),
  by Lt. Colonel Edwin G. Triner

- Data Management & the Contractor's Organization,
  by Donald R. Spencer

- Question and Answer Session,
  Moderator: Joseph Mazia
  Panelists: Colonel C. T. Campbell
  Lt. Colonel William O. Rennhack
  Lt. Colonel Edwin G. Triner

J. MAZIA
PRESIDING CHAIRMAN

B.G. SCHAEFER
RECORDING SECRETARY

R.L. GOLDSTON

COL. C.T. CAMPBELL
USA

LT. COL.
W.O. RENNHACK
USAF

LT. COL. E.G. TRINER
USAF

D.R. SPENCER

DATA MANAGEMENT AT MARSHALL SPACE FLIGHT CENTER

Mr. R. Lamonte Coldston
Center Apollo Data Manager
Industrial Operations
Marshall Space Flight Center

Slide #1 - Two years ago, at your sixth annual meeting, I spoke to you about NASA intentions in data management. As I reported to you then, we were reviewing other data management systems for possible application to the Apollo program. Since that time, based on what we learned, we have developed our own data management system, our policies and techniques. We are now well on our way to implementing data management at Marshall Space Flight Center. It is the MSFC data management story that I will tell you today.

Slide #2 - A pre-requisite to implementing data management, in any organization, is the unqualified, publicized support of top management. Dr. George Mueller, in congressional testimony, stated that "......paperwork is a costly operation, vital to accomplishing our program......" This statement indicates that we should pay particular attention to the cost of data and the essentiality of data.

Slide #3 - At Marshall Space Flight Center, the policy is well established that "......the Apollo data management program will be vigorously pursued and effectively implemented."

At MSFC, we are fortunate to have strong top management support. This, in itself, does not assure success but it goes a long way.

Slide #4 - No presentation would be complete without definitions. I would like to give you three of our fundamental definitions. "Data" is defined as factual material used as a basis for discussion or decision. In our data management system we are more interested in managing data, or information, than documents. "Document" is a means of communicating or recording information. It may be in the form of a report, a specification, film, tapes, or photographs. Data and document, within our system are all inclusive. No form of data and no documents are excluded. This runs the gamut from financial data to mission operations data.

Data management is the organizing, planning, measuring, and controlling of the identification, preparation and dissemination of data.

I am sure you recognize the four basic elements of management: organizing, planning, measuring and controlling. Any good data management system should contain these elements.

Slide #5 - Why Data Management?

There must be reasons why there is so much interest in data management. Seven reasons come to mind. First, data is the primary means of communication by which a program is managed. This is particularly important to MSFC, since the bulk of our program is accomplished by contractors at widely dispersed locations. Second, document costs are extremely high. Some estimates place this figure at 50-60 percent of program costs. Third, in the past, no central management structure existed for data. This in itself tends to create disorder and lack of management. Fourth, frequently inadequate data is procured. This leaves large gaps in our communications. Fifth,

DATA MANAGEMENT at MSFC

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTS... A..BAMA

Presented To: 8th Annual Meeting
Engineering Documentation Section
Technical Documentation Division
American Ordnance Association

By: R. Lamonte Goldston
Center Apollo Data Manager

Date: April 28, 1966

"AN IMPORTANT ASPECT OF MANAGEMENT WHICH IS OFTEN OVERLOOKED IS THAT OF PAPERWORK CONTROL. BECAUSE PAPERWORK IS A COSTLY OPERATION, VITAL TO ACCOMPLISHING OUR PROGRAM, WE HAVE ESTABLISHED AN APOLLO DOCUMENTATION MANAGEMENT SYSTEM......."

Dr. George Mueller, Associate
Administrator for Manned
Space Flight, National Aeronautics
and Space Administration.

"THE MANAGEMENT OF DOCUMENTATION ASSOCIATED WITH A COMPLEX PROGRAM SUCH AS APOLLO IS AN EVER-INCREASING PROBLEM. FOR THAT REASON, THE NASA APOLLO DATA MANAGEMENT PROGRAM HAS BEEN INSTITUTED.

THIS MANUAL IS THE EXTENSION OF THAT EFFORT TO MARSHALL. IT IS THE POLICY OF THIS CENTER THAT THE APOLLO DATA MANAGEMENT PROGRAM WILL BE VIGOROUSLY PURSUED AND EFFECTIVELY IMPLEMENTED.

I SOLICIT THE SUPPORT OF ALL EMPLOYEES IN MAKING THIS PROGRAM A SUCCESS"

Eberhard Rees
Deputy Director, Technical

DEFINITIONS

DATA - Factual material used as a basis for discussion or decision.

DOCUMENT - A means of communicating or recording information. It may be in the form of a report, a specification, film, tapes or photographs.

DATA MANAGEMENT - The organizing, planning, measuring and controlling of the identification, preparation and dissemination of data.

WHY DATA MANAGEMENT ?

1. DATA IS THE PRIMARY MEANS OF COMMUNICATION BY WHICH A PROGRAM IS MANAGED
2. DOCUMENT COSTS ARE EXTREMELY HIGH
3. IN THE PAST, NO CENTRAL MANAGEMENT STRUCTURE EXISTED FOR DATA
4. FREQUENTLY, INADEQUATE DATA IS PROCURED
5. NON-ESSENTIAL DATA IS OFTEN ACQUIRED
6. POOR OR NON-EXISTENT DELIVERY SCHEDULES
7. DUPLICATE DATA IS PROCURED

non-essential data is often acquired. The most essential data is then buried in a mountain of trivia. Sixth, poor or non-existent delivery schedules contribute to data "too-early" or "too-late" for the purpose intended. Seventh, duplicate data is procured to add again to the mass of trivia.

Slide #6 - Let's look now at the benefits of data management. These benefits are not always obvious. With the national spotlight on saving money, one of the benefits is usually that of reduced costs. However, this is true only when excess data has been allowed to permeate the system. Such has been the case at MSFC. Improved communication on a timely basis improves program controls, thereby enhancing decision making capability. Since data are the controlling and pacing item for hardware, improving data results in more effective hardware support.

Slide #7 - An ad hoc team, composed of representatives from MSFC, Manned Spacecraft Center, Kennedy Space Center and NASA Headquarters, established the basic policies and procedures for the Apollo program in NPC 500-6. Subsequently, we at MSFC, published a complementing instruction, MSFC 500-6. Some of the basic policies set down in these documents were:

Requirements Identified and Defined Early
Essential Data Only
Each Requirement Justified
Requirements Contractually Imposed

Slide #8 - Data Management in Action

There are basically six major types of participants in our data management program. They are:

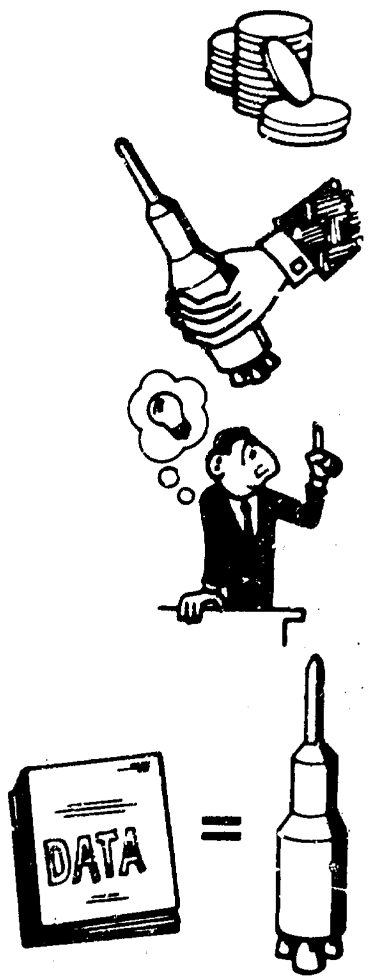
- Program Manager
- Center Apollo Data Manager
- Data Managers
- Requiring Organization
- ad hoc Data Review Team
- Respondent

Slide #9 - Let's look, just briefly, at the role of each of the six. The success of data management implementation at MSFC, rests in the hands of the program, project, and stage managers. These managers apply the policies and procedures for the administration and operation of the data management program. The manager approves the data requirements and controls distribution of the documents. He appoints specialists who make up the ad hoc data review team and usually chairs the meeting. As the Center Apollo Data Manager, I serve as a consultant on the data management system. In data management, I interface with the other Apollo centers (MSC and KSC) and with the Apollo Program Office. One of my major roles is assisting the program managers and requiring organizations with their documentation problems. I perform audits and monitor the data management system to assure proper administration and operation. A data manager has been named for each of the following:

- MSFC Staff Elements
- Research and Development Operations
- Industrial Operations

These managers are involved in the daily administration of the data management system.

BENEFITS OF DATA MANAGEMENT

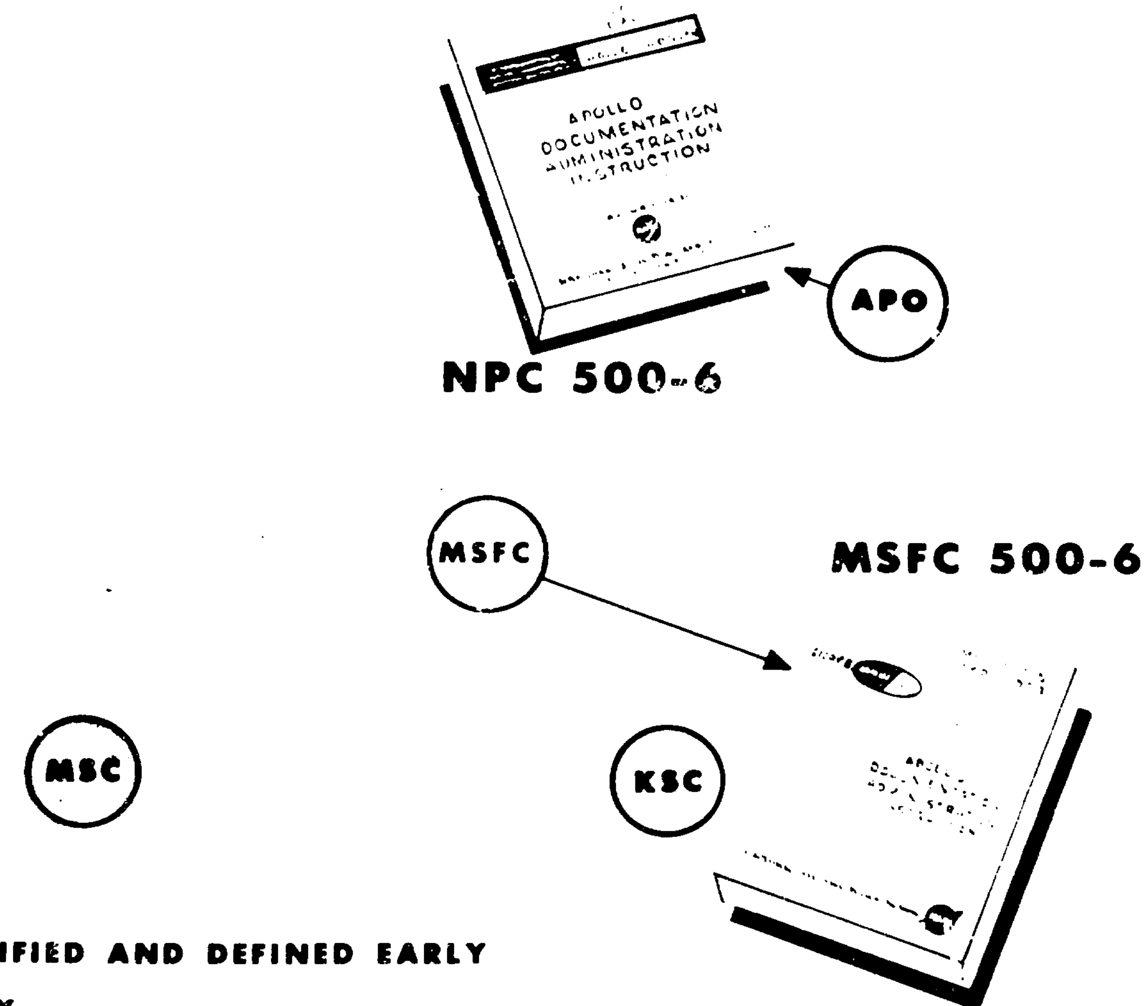


REDUCED COSTS

IMPROVED PROGRAM CONTROLS

ENHANCED DECISION MAKING CAPABILITIES

EFFECTIVE HARDWARE SUPPORT

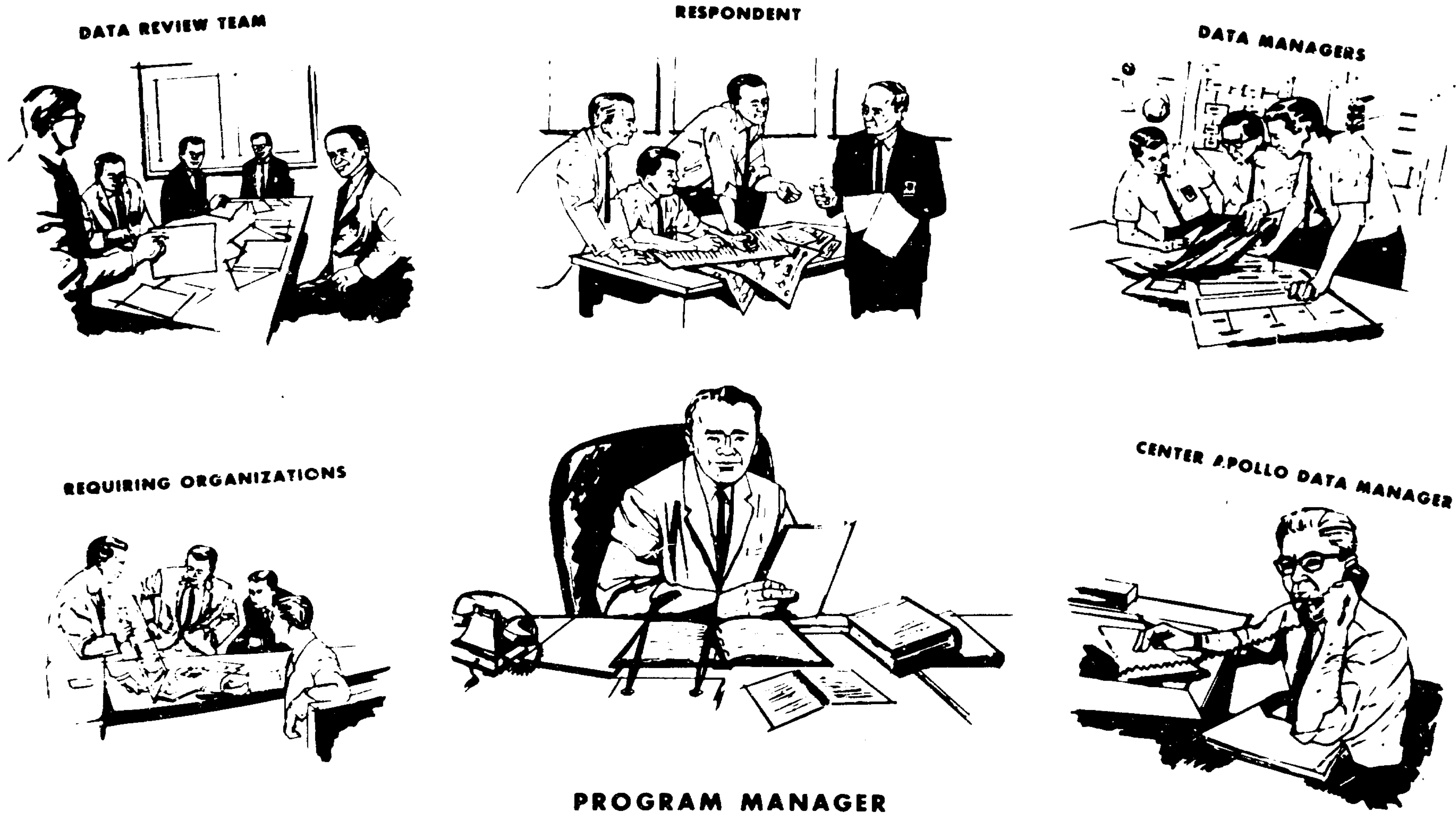


SYSTEM POLICIES

- REQUIREMENTS IDENTIFIED AND DEFINED EARLY
- ESSENTIAL DATA ONLY
- EACH REQUIREMENT JUSTIFIED
- REQUIREMENTS CONTRACTUALLY IMPOSED

Slide #7

DATA MANAGEMENT IN ACTION



PROGRAM MANAGERS

The Program/ Project/ Stage Manager applies approved policies and procedures for the administration and operation of the Center Apollo Data Management program within his area of responsibility. He approves the data requirements under his jurisdiction. He also appoints the specialists who compose the AdHoc Data Review Team.

CENTER APOLLO DATA MANAGER

The Center Apollo Data Manager serves as a consultant for all matters related to the Data Management System. He handles documentation interface activities at intra-Center, inter-Center and Apollo Program Office Headquarters levels. One of his major roles is assisting the Program/ Project/ Stage Manager and Requiring Organizations with their documentation problems.

DATA MANAGERS

Data Managers are involved in the daily administration and operation of the Data Management System. They maintain close liaison with the Requiring Organizations and assist the Center Apollo Data Manager in his coordination efforts.

Slide #10 - The real hub of our data management activities evolve around our requiring organizations, who identify, define and justify their documentation needs.

The Center Apollo ad hoc Data Review Team is made up of specialists who review the requirements and make recommendations to the program managers.

The respondent prepares and submits the required documents. It is the respondent who provides estimated cost data. The respondent may be a contractor, another center, Apollo Program Office or another government agency.

Not shown on the viewgraph, but a very vital part of our system is the General Electric Company of Huntsville, Alabama, who serve in the role of mission support contractor for MSFC data management. We are fortunate, at MSFC, to have their able support and assistance.

Slide #11 - Directives

Realizing that directives are necessary, we have prepared those required to implement data management within MSFC. This is true for, not only MSFC level, but for those required by the operating elements of research and development operations and industrial operations. Instructions have been issued for preparation of data management forms, and two training brochures have been published.

Slide #12 - Training

Recognizing data management as a new, unfamiliar technique at MSFC, we set about to train, not only our data management personnel, but other participants in our program. We have published the green brochure, "The Marshall Concept," primarily for managers. This brochure is short enough for them to read, but comprehensive enough for training. The blue brochure is a more detailed explanation of our system, including detailed phasing information and procedures. This brochure is for data management practitioners. To date we have trained 220 people in a formal training program. This includes MSFC prime and support contractors. The training program is continuing. The majority of the viewgraphs you will see today are from that training program.

Slide #13 - We have identified and established a basic data requirements cycle at MSFC:

Identify
Define
Justify
Acquire
Record
Survey and Evaluation

The survey and evaluation cycle concerns itself with monitoring the data management system through audits and quality surveys. Now let's look at the first five events of the cycle.

Slide #14 - A survey of existing documents was made in 1964, fed to a computer and the result was the Center Apollo Docur Index (CADI). This document has been published four times and is the best identifying tool for existing documents.

REQUIRING ORGANIZATION

The Requiring Organizations identify, define and justify their documentation needs. The Data Management System is designed to assist these groups in identifying their minimum essential requirements.

AD HOC DATA REVIEW TEAM

The Center Apollo AdHoc Data Review Team reviews the data requirements of the Requiring Organizations and makes appropriate recommendations to the Program/Project/Stage Manager concerning the adequacy of the re uirements.

RESPONDENT

The Respondent prepares and submits the documents authorized by contract. During the proposal stage, the Respondent provides estimated costs for preparation of the documents and makes recommendations concerning the adequacy of the data requirements. It is important to remember that a Respondent may be a contractor, an Apollo Field Center, Apollo Program Office Headquarters, or some other Government agency.

REFERENCE PUBLICATIONS

NPC 500-6	"APOLLO DOCUMENTATION ADMINISTRATION INSTRUCTION"
MSFC 6-4	"MSFC REPORTS MANAGEMENT CONTROL"
MSFC 6-24	"R&DO SUPPORT OF I.O. PROJECTS AND SYSTEMS"
MSFC 25-2	"REQUESTS FOR ENGINEERING DWGS, SPECS, AND RELATED DOCUMENTS"
MSFC 500-6	"APOLLO DOCUMENTATION ADMINISTRATION INSTRUCTION"

I. O. DIRECTIVE I-1-20 "DATA MANAGEMENT IMPLEMENTATION WITHIN INDUSTRIAL OPERATIONS"

MEMO DATED NOVEMBER 24, 1965, SUBJECT: "INSTRUCTION FOR COMPLETION OF DATA MANAGEMENT FORMS" (BY CADM)

R&DO DIRECTIVE 4-10, "IMPLEMENTING DATA MANAGEMENT WITHIN R&DO CONTRACTS"

R&DO DIRECTIVE 25-1, "DISTRIBUTION, WITHIN R&DO, OF TECHNICAL DOCUMENTS"

R&DO DIRECTIVE 4-13, "IMPLEMENTING DATA MANAGEMENT WITHIN R&DO"

TRAINING BROCHURE (GREEN COVER) - APOLLO DATA MANAGEMENT-"THE MARSHALL CONCEPT"

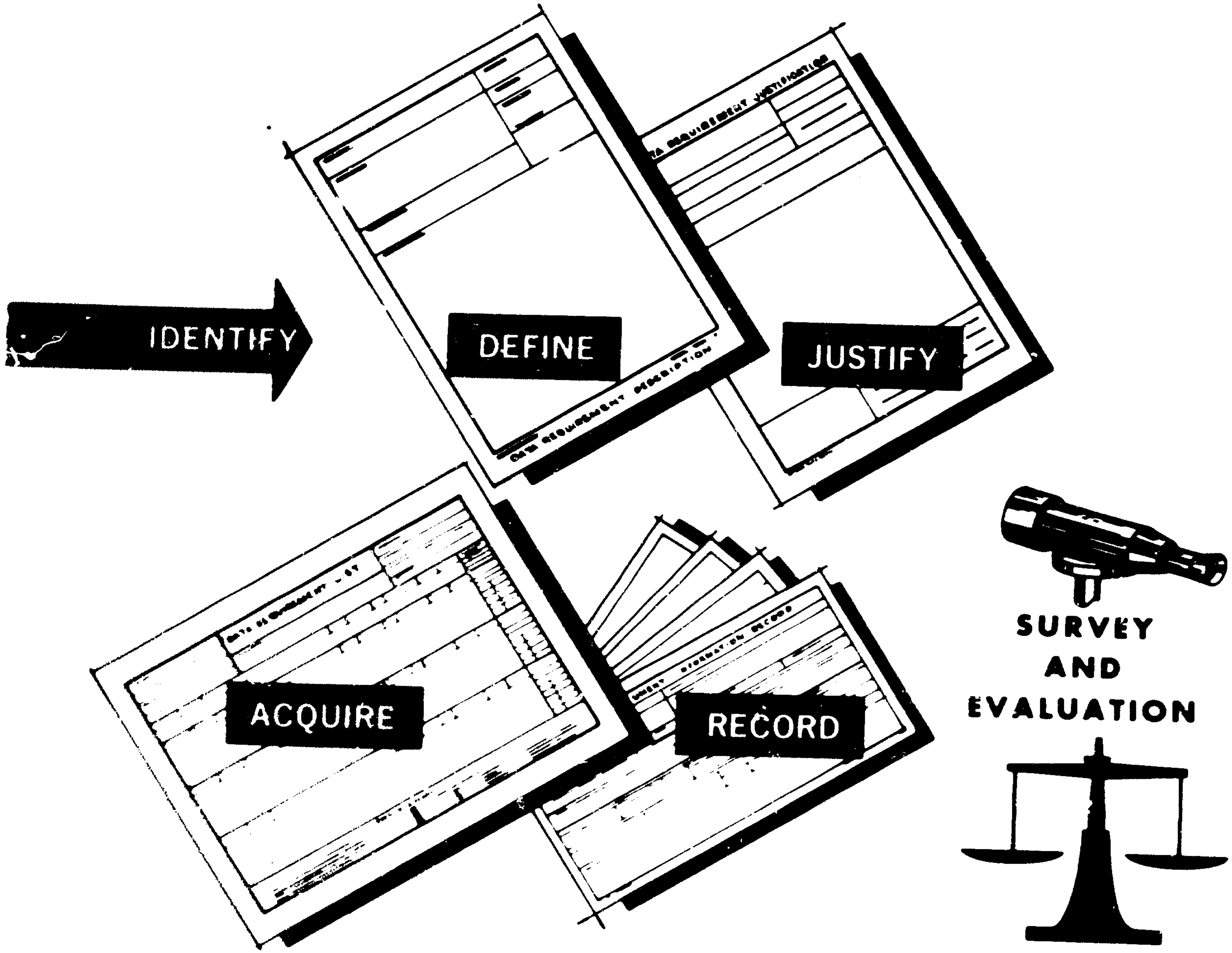
TRAINING BROCHURE (BLUE COVER) - "INTRODUCTION TO DATA MANAGEMENT"

DIRECTIVES

I-RM-M-512A


INTRODUCTION
TO
DATA
MANAGEMENT
TRAINING
FOR TRAINING PURPOSES ONLY
THE MARSHALL CONCEPT

Slide #12


IDENTIFY
DEFINE
JUSTIFY
ACQUIRE
RECORD
SURVEY
AND
EVALUATION

Slide #13


CENTER
APOLLO DOCUMENT INDEX
NASA
National Aeronautics and Space Administration
NASA

Slide #15 - As the data management system is implemented, information, concerning the data requirements is placed in a computerized data bank. Periodically, a center authorized data list, which identifies only implemented requirements, will be published. This will also serve as an identifying tool. This document has not been officially published, but an initial run has been made for evaluation.

Slide #16 - The Document Requirement Description (DRD) is used to define the data requirement. The DRD numbering is based on 17 categories, with alpha prefix and numerical sequencing. The MA-010 means the program management category and the tenth DRD published. We have found it necessary to add a revision block to our DRD, otherwise, our application is similar to the form 9.

Slide #17 - Our DRD's are compiled into three volumes called the Center Apollo Document Description Standards (CADDS). This is our main tool for uniformity. Our MSFC personnel are asked to select data requirements from the CADDS before requesting a new, unique DRD. This, then, tends to enhance standardization and uniformity. However, if a data requirement is truly unique, a new DRD will be prepared and will enter the system. Our CADDS are our MSFC version of volume II of manual 310-1. We have 589 DRD's presently in our CADDS.

Slide #18 - Our Document Requirement Justification (DRJ) form does just that. The DRJ is rather unique to the MSFC system, but we find it very effective. The front of the form contains some basic information, a coordination summary, and signatures. Approval signature is by the program manager. The lower left hand corner contains a block to check concerning Bureau of Budgets approval of a new form. The back, or business side, of the form contains specific information for the necessity for the document, how the document will be used and by whom.

This is one document that must be filled out by the requiring organization with no help from my office.

Slide #19 - Our Data Requirements List (DRL) is our primary acquisition tool. You may notice a similarity with the 1423's. At MSFC, we include general provision items on the DRL, thus making the DRL the total and only tool for ordering data. Block 2 contains the applicable DRD number. Block 4, OPR is the Office of Primary Responsibility within MSFC. Block 6 is information concerning inspection and acceptance mode and location. Number of copies and reproduction media are shown in block 11. The remarks section is used to document minor additions, deletions or deviations from the uniform DRD's selected from the CADDS.

Information contained on the DRL is placed in our Center Apollo Data Management Information System (CADMIS) and is the basis for the CADL mentioned earlier. The right hand portion is a tear off portion. Let's look at it more closely.

Slide #20 - This portion contains our cost data. Contractors are asked to estimate their use of the document in percentage in block 12.

The method of arriving at costs are put in block 13 as estimated or actual.

Block 14 contains the total cost for the DRL line. These costs are then broken down into four elements:

Block 17 - Reproduction and Delivery Cost
Block 18 - Preparation Cost (Administrative)
Block 19 - Preparation Cost (Technical)
Block 20 - Development Cost


GEORGE C. MARSHALL SPACE FLIGHT CENTER
CENTER
AUTHORIZED DATA LIST
Alphabetical Listing
National Aeronautics and Space Administration
Numerical Listing
By Level Category Control No. 1
NASA

Slide #15

TITLE

a. Report, Quarterly Progress

NUMBER

b. MA-010

REV

A

DATE July 15, 1965

OFFICE OF PRIMARY RESPONSIBILITY

e.

APPROVED (NAME-TITLE)

REFERENCES

f.

USE

c. To provide a permanent record of the contractor's performance, problems, problem solutions, and recommendations in the performance of the contract.

DRD

INTERRELATIONSHIP

g. MA-001, Program Plan
SC-001, NASA PERT System Plan
MF-001, Financial Management Report

PREPARATION INFORMATION

h. 1. The contractor shall prepare and submit a report of all work accomplished during each three (3) month period of contract performance. In addition to factual data, this report shall include a separate analysis section interpreting the results obtained, recommended action, problem areas and related occurrences to the ultimate objectives of the contract work.

2. The report shall be categorized to provide the progress of all performance areas such as the following:

(a) Management
(b) Manufacturing
(c) Procurement
(d) Quality
(e) Reliability
(f) Testing
(g) Documentation
(h) Tooling
(i) Facilities

DEFINE

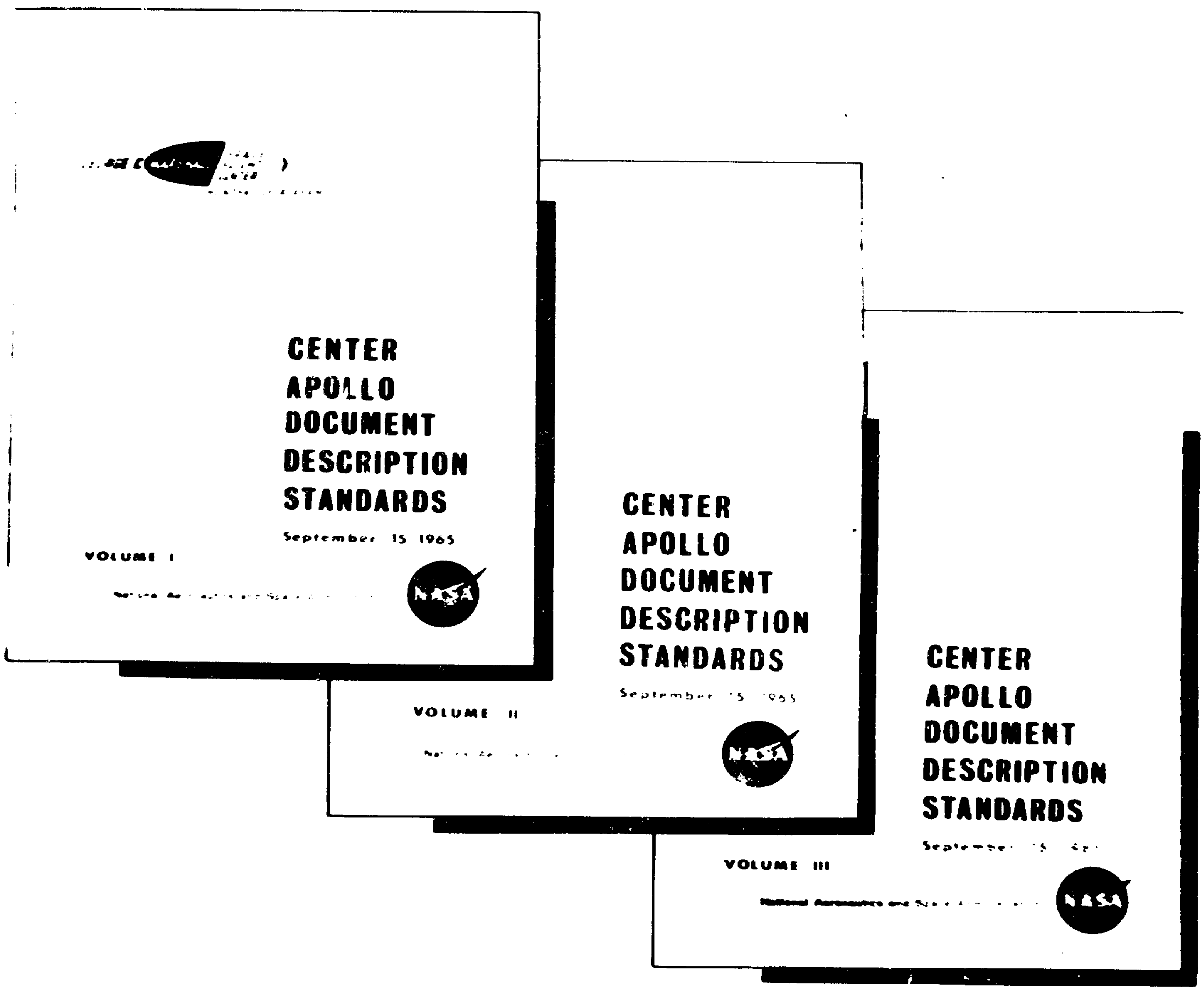
3. Sufficient diagrams, sketches, curves, photographs, and drawings shall be included to convey or portray the intended meaning(s) of data, analysis, results, etc. (as applicable).

4. The reproduction, distribution, and frequency of submittal of the report shall be as specified on NASA Form 1106, Document Requirement List (DRL).

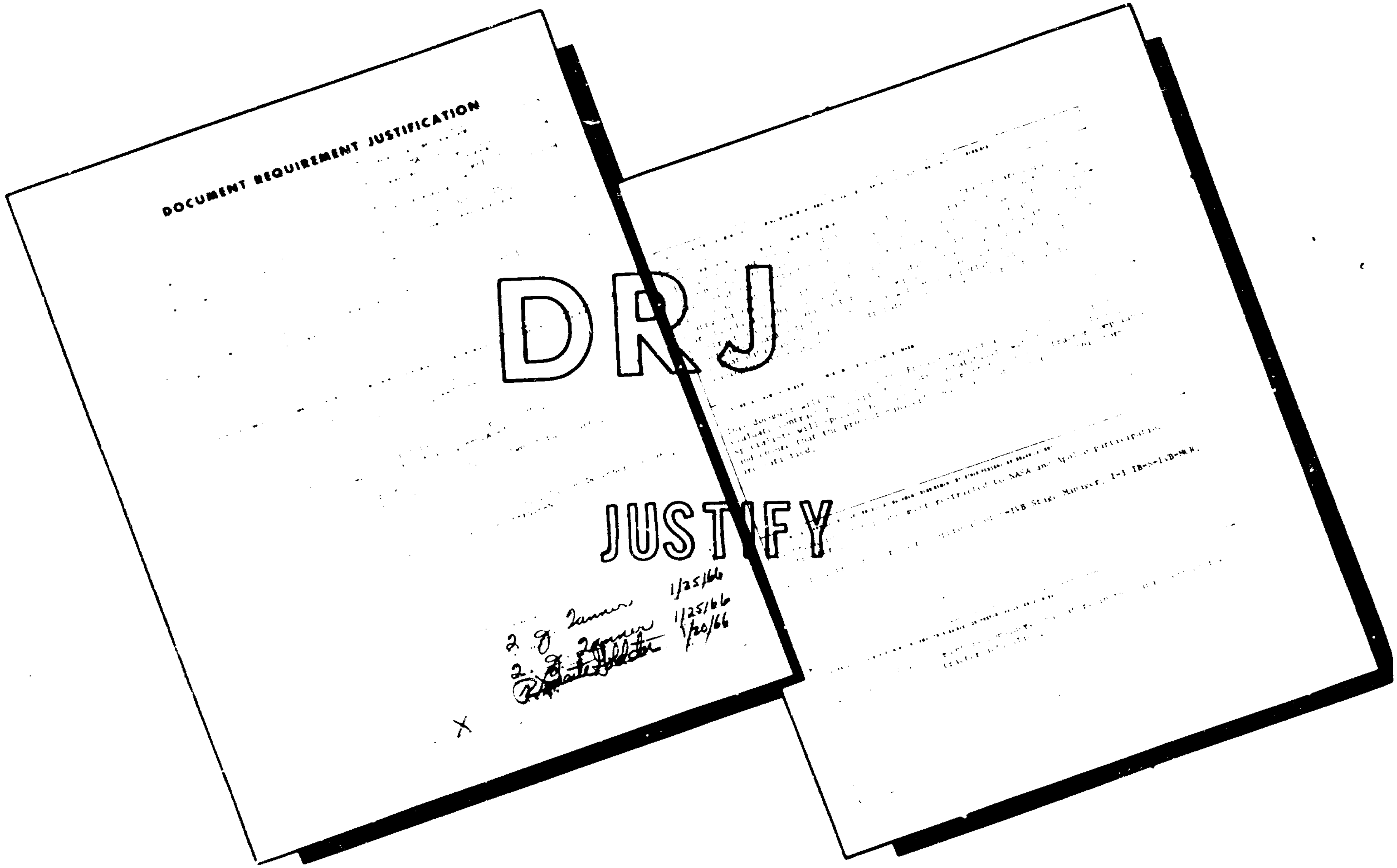
Page 1 of 1 Pages

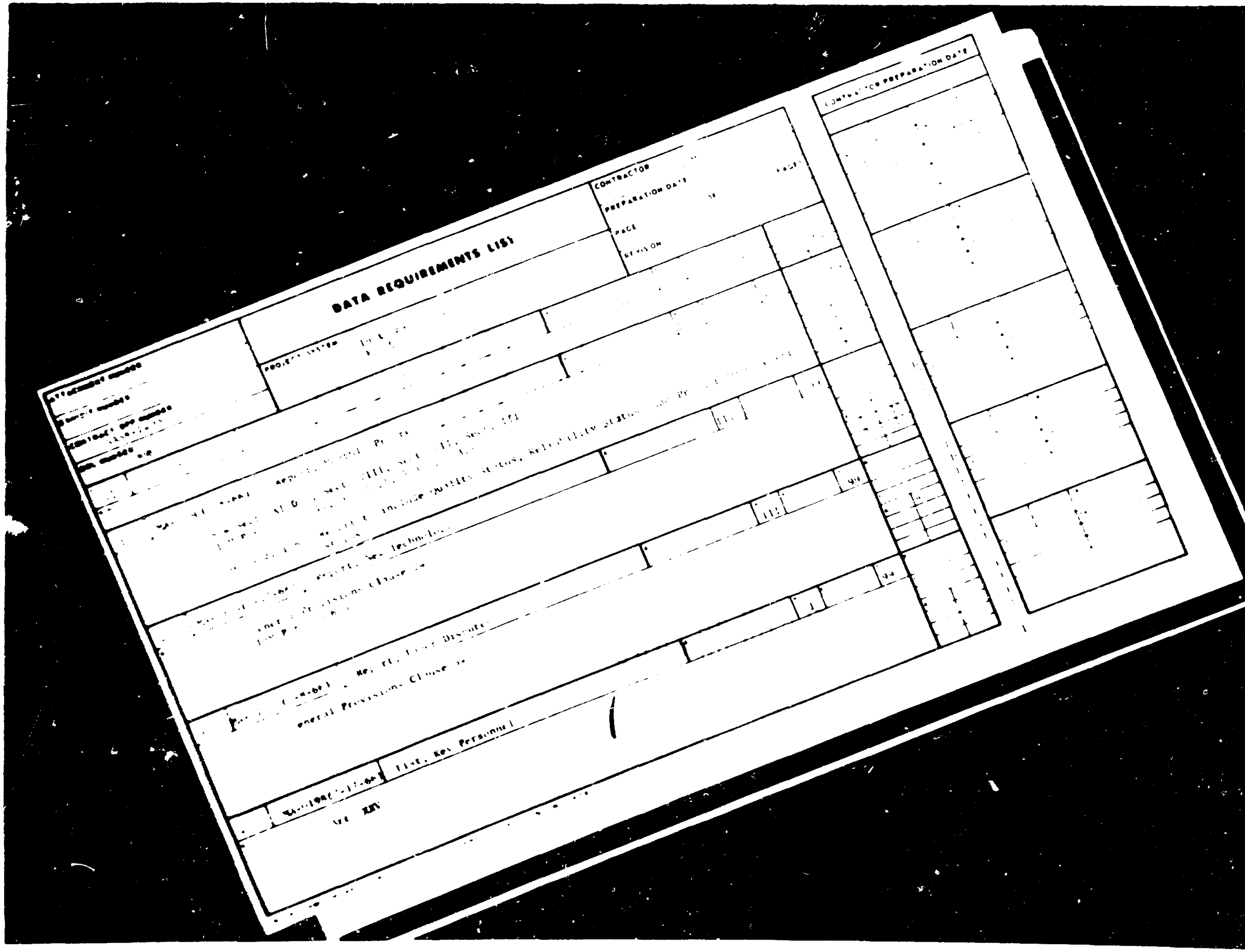
NASA FORM 1107 (JUN-65) PROPOSED

DOCUMENT REQUIREMENT DESCRIPTION (DRD)


CENTER
APOLLO
DOCUMENT
DESCRIPTION
STANDARDS
September 15 1965
VOLUME I
CENTER
APOLLO
DOCUMENT
DESCRIPTION
STANDARDS
VOLUME II
CENTER
APOLLO
DOCUMENT
DESCRIPTION
STANDARDS
VOLUME III

Slide #17


DOCUMENT REQUIREMENT JUSTIFICATION
DRJ
JUSTIFY



D1-23

Slide #19

CONTRACTOR PREPARATION DATE		
3/12/66		
12 CONTR USE	13 EST ACT	14 TOTAL COST
15 EST NO. SUBM PGS PER SUBM		18 PREP. COSTS (ADMIN)
16 EST NO. REV/ PGS PER REV		19 PREP. COSTS (TECH)
17 REPRO AND DELIV. COST		20 DEVELOP COST
21 REMARKS		
12 50	13 EST	14 $600
15 1/23		18 $100
16 N/A N/A		19 $475
17 $25		20 NONE
21		
12	13	14
15		18
16		19
17		
21		

COST DATA

ECTION BEFORE PLACING ON CONTRACT

Slide #20

The policy of MSFC is to obtain estimated data costs, but exclude the tear-off portion from contract negotiations. We are now having, and expect to continue to have difficulty in securing cost data.

However, I feel we must come to gripe with this and obtain a solution if the full benefits of data management are to be realized.

Slide #21 - The Document Information Record (DIR) is used to record information concerning individual submittals of documents against the data requirement. This means, in effect, we have a closed-loop data system at MSFC. The DIR is an accountability tool and is used primarily to feed information to the data bank (CADMIS). It is not used in lieu of a DD Form 250, but in addition to it. Individual submission can be tracked and monitored against the original requirement using computer techniques. Cost tracking and correlation can be accomplished since document costs are included on the DIR.

Slide #22 - System Policies

Ten basic system policies have been established for data management at MSFC.

First, identification of current and forecasted requirements as early as possible. We find that implementing on existing contract is difficult. However, when started during the RFP phase, implementation is clean and relatively easy.

Second, each data requirement must be fully justified, using the DRJ. We find that many times the chore of completing the DRJ is enough to make the requirement disappear.

Third, requirements shall be properly defined, using the DRD. Of course, the better the DRD is prepared, the better the documents will be. Also, the better the results from quality survey and data audit.

Fourth, requirements shall be subject to approval by program/project/stage manager.

Fifth, only essential data shall be acquired. If data management at MSFC has a theme song, this would be it.

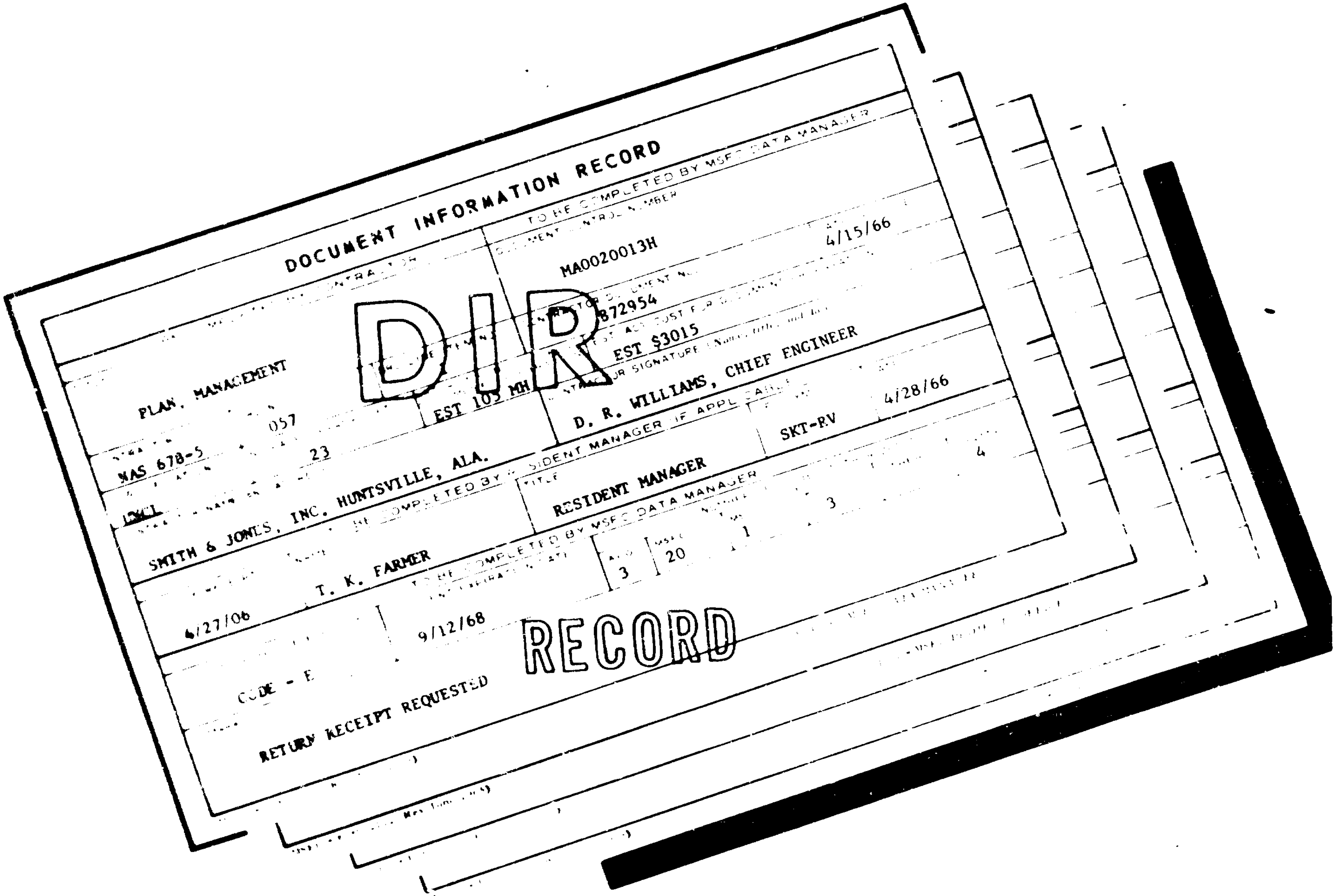
Slide #23 - Sixth, requirements shall be contractually imposed, using the DRL and DRD's. I can't stress this too much. Within our system, the DRL is the total, sole, complete listing of data required and no parent document can cause documents to be generated by the contractor.

Seventh, delivery schedules shall be specified. Data must be submitted at proper time to be useful.

Eighth, document accountability shall be maintained, using the Center Apollo Data Management Information System (CADMIS).

Ninth, distribution will be controlled. This is the thought that the data must get to the right person to be effective.

Tenth, compliance of data with contractual requirements will be monitored, using the data audit and the data management assistance survey.


DOCUMENT INFORMATION RECORD
DIR
PLAN. MANAGEMENT
057
NAS 678-5
23
EST 105 MH
SMITH & JONES, INC. HUNTSVILLE, ALA.
T. K. FARMER
4/27/06
9/12/68
TO BE COMPLETED BY MSFC DATA MANAGER
MA0020013H
4/15/66
872954
EST $3015
D. R. WILLIAMS, CHIEF ENGINEER
4/28/66
SKT-RV
RESIDENT MANAGER
3
20
1
3
4
RECORD
CODE - E
RETURN RECEIPT REQUESTED

Slide #21

SYSTEM POLICIES

1. Identification of current and forecasted requirements as early as possible
2. Each data requirement must be fully justified (DRJ)
3. Requirements shall be properly defined (DRD)
4. Requirements shall be subject to approval by Program/Project/Stage Manager
5. Only essential data shall be acquired

SYSTEM POLICIES (CONTINUED)

6. Requirements shall be contractually imposed (DRL)
7. Delivery schedules shall be specified (DRL)
8. Document accountability shall be maintained (CADMIS)
9. Distribution will be controlled
10. Compliance of data with contractual requirements will be monitored (Data Management Assistance Survey)

Slide #24 - "Operation Papermill" is our own data management version of the incentive awards program giving non-monetary awards and recognition. This program is used to generate an awareness of excessive paperwork and procedures throughout MSFC. A very beneficial by-product has been a growing interest in elimination of non-essential documents. This program was just begun in December 1965, but has already produced 120 suggestions.

Slide #25 - Cost Reduction/Avoidance

Recognizing the national interest in cost reductions, we are paying particular attention to this area at MSFC. We have officially submitted $10,851,779 in data management cost reductions/avoidances. This covers a period of 18 months. Listed on the viewgraph are some examples of our more significant reductions.

Slide #26 - Completed Contractual Implementation

We have completed contractual implementation in seven major areas within MSFC, with first being data management mission support contract with General Electric Company in September 1965.

Total contract value represented by the areas shown amounts to approximately 935 millions of dollars. Our data reductions within these applications have been rather spectacular. On one contract, we avoided 65% of the originally defined requirements. Translated into document submittals, this amounted to 7,100 and 213,000 copies were avoided.

Slide #27 - Scheduled Contractual Implementation

We show here the latest scheduling on twelve major areas of contractual implementation, within MSFC. These are not hard and fast schedules, but are target dates. The total contract value representated by these areas is one billion, four hundred and eighty seven million dollars.

This schedule does not project beyond July 1966. There will be, of course, further implementation of data management at MSFC.

In Conclusion

We, at MSFC, are implementing data management in a positive manner. We have our organizations essentially established and functions identified. Our directives have been published and our system has been defined. Our data management tools have been developed and proofed through usage. Our training program is well under way. We feel the future of data management at MSFC is very bright. If the future can be judged from the past, data management will be very beneficial to MSFC, as a center, and as part of the Apollo program.

"OPERATION PAPERMILL"

IS YOUR OPPORTUNITY TO PARTICIPATE IN A CAMPAIGN TO REDUCE PAPER WORK AT MSFC*

"OPERATION PAPERMILL" SUGGESTION FORM

✔ CHECK ONE OR MORE ITEMS AND CIRCLE DESCRIPTION

A. ELIMINATION OF PAPER: Form, Report, Document, Other

B. COMBINATION OF PAPER: Forms, Reports, Documents, Other

C. CHANGE in Practice, Procedure, Method

D. REDUCTION of Paper through Stop or Change of Distribution

E. SAVING of Money or Labor through Reproduction Change

■ DESCRIPTION OF PAPER UNDER REVIEW (TITLE, NUMBER, SUBJECT, PURPOSE)

■ SUGGESTED ACTION, INCLUDING ANTICIPATED BENEFITS, IF IMPLEMENTED

■ SUGGESTOR'S ESTIMATE OF RESULTANT SAVINGS IN MONEY, TIME, SHEETS, ETC.

SUGGESTOR'S NAME

OFFICE SYMBOL

OFFICE TELEPHONE

MSFC - Form 2554-OT (DEC. 1965)

TEAR ON DOTTED LINE

DATA MANAGEMENT COST REDUCTION/AVOIDANCE

MSFC STAFF		$ 295,296
R&DO		961,902
IO		9,594,581
	TOTAL	$ 10,851,779

SIGNIFICANT REDUCTION/AVOIDANCES

PROGRAM/PROJECT	ORIGINATOR	AMOUNT	REMARKS
S-IVB	I-V-S-IVB	$3,411,000	Elimination of Contractor Reports.
S-II	I V-S-II	1,484,400	Elimination of 17 Manuals.
R&DO	R-COMP	337,200	Improved Data Techniques.
LVGSE	I-V-G	300,000	Stop LVGSE Test Plan.

COMPLETED CONTRACTUAL IMPLEMENTATION OF DATA MANAGEMENT

TITLE	CONTRACTOR	CONTRACTUAL IMPLEMENTATION (DATE)
DATA MANAGEMENT	GENERAL ELECTRIC	SEPTEMBER 65
DISCRETE CONTROL (S-V)	BROWN	SEPTEMBER 65
C-1 ENGINE	THIOKOL	OCTOBER 65
S-IB STAGE (S-IB)	CCSD	JANUARY 66
S-IB GSE	CCSD	JANUARY 66
ESE (S-IB & V)	GENERAL ELECTRIC	FEBRUARY 66
S-IC STAGE (S-V)	BOEING	FEBRUARY 66

I-RM-M-325B Goldston April 21, 1966

SCHEDULED CONTRACTUAL IMPLEMENTATION OF DATA MANAGEMENT

TITLE	CONTRACTOR	CONTRACTUAL IMPLEMENTATION (DATE)
S-II STAGE (S-V)	NAA (S&ID)	APRIL 66
F-1 ENGINE	NAA (ROCKETDYNE)	SEPTEMBER 66
J-2 ENGINE	NAA (ROCKETDYNE)	JULY 66
S-IVB STAGE (IB & V)	DOUGLAS	MAY 66
H-1 ENGINE	NAA (ROCKETDYNE)	JUNE 66
APOLLO APPLICATIONS PROGRAM	(RFP)	JUNE 66
SATURN V INTEGRATION (SE&I)	BOEING	JULY 66
SATURN V MGSE	BOEING	JULY 66
SATURN V L/V	BOEING	JULY 66
IU (S-IB & S-V)	IBM	JULY 66

I-RM-M-327C Goldston April 21, 1966

THE ARMY CONCEPT AND ORGANIZATION FOR TECHNICAL DATA MANAGEMENT

Colonel Charles T. Campbell
Chief Technical Data Office
HQ. US Army Materiel Command

Slide #1 - It is indeed a pleasure to be invited to participate at this, your Eighth Annual Meeting. In the few minutes allotted me, I hope to give you as concise and clear a picture, as I can concerning our concept and organization for technical data management within the Army.

Slide #2 - When I use the term Technical Data, please think of it as a short term of reference, encompassing technical logistic as well as scientific data and information. This includes such diverse documents as research and development technical reports, military specifications, engineering drawings, maintenance manuals, and so forth. The documentation, of course, may be in printed form, on microfilm, on magnetic tape, or any other medium of communication.

Slide #3 - The Department of Defense defines Technical Data as the means for communication of concepts, plans, descriptions, requirements, and instructions relating to technical projects, materiel, systems, and services. These may include specifications, standards, engineering drawings, associated lists, manuals, and reports, including scientific and technical reports; they may be in the form of documents, displays, sound recordings, punched cards, and digital or analog data. Technical data and information may be required for definition of a military requirement, program definition, technical monitoring, design and development, test and evaluation, configuration control, prototype manufacturing, procurement, production, processing, cataloging, standardization, training, operation, maintenance, repair, and emergency re-manufacturing.

How to manage this broad spectrum of technical data is what we are concerned with. And let me assure you that it is not a concern of the Army alone, but of the entire Defense establishment, and the Congress of the United States.

Slide #4a - The high cost of acquiring and handling technical data, coupled with the necessity of avoiding duplication of effort, and reducing research, development, and procurement lead time, have led to the inescapable conclusion

Slide #4b - that we must manage our technical data resources with the same care that we manage our materiel, manpower, and financial resources.

Before I get deeper into the discussion of my topic, I feel that it is necessary to give you some background information concerning the Army Materiel Command itself.

Slide #5 - The Army Materiel Command, as you will note on this chart, is one of several Department of the Army major commands, such as the Combat Developments Command, and the Continental Army Command. It was activated about three years ago to consolidate and coordinate the materiel development and logistics functions of the Army. It was created from components of six former Army Technical Services, such as the Ordnance Corps, the QuartermasterCorps, and the Signal Corps. Our major organizational units are seven major subordinate commands, which are also shown on this chart. The first five of these commands, reading from left to right, are known as

ARMY TECHNICAL DATA MANAGEMENT PROGRAM

COL C. T. CAMPBELL

Slide #1

TECHNICAL DATA MANAGEMENT

DEFINITION OF TECHNICAL DATA

- LOGISTIC & SCIENTIFIC DATA AND INFORMATION
- DOCUMENTATION MEDIA
- DOD DEFINITION

Slide #2

DEPARTMENT OF DEFENSE INSTRUCTION 5010.12

DEFINITION

TECHNICAL DATA & INFORMATION- THE MEANS FOR COMMUNICATION OF CONCEPTS, PLANS, DESCRIPTIONS, REQUIREMENTS, & INSTRUCTIONS RELATING TO TECHNICAL PROJECTS, MATERIEL, SYSTEMS, & SERVICES. THESE MAY INCLUDE SPECIFICATIONS, STANDARDS, ENGINEERING DRAWINGS, & ASSOCIATED LISTS, MANUALS, & REPORTS, INCLUDING SCIENTIFIC & TECHNICAL REPORTS; THEY MAY BE IN THE FORM OF DOCUMENTS, DISPLAYS, SOUND RECORDINGS, PUNCHED CARDS, & DIGITAL OR ANALOG DATA. TECHNICAL DATA & INFORMATION MAY BE REQUIRED FOR DEFINITION OF A MILITARY REQUIREMENT, PROGRAM DEFINITION, TECHNICAL MONOTORING, DESIGN & DEVELOPMENT, TEST & EVALUATION, CONFIGURATION CONTROL, PROTOTYPE MANUFACTURING, PROCUREMENT, PRODUCTION, PROCESSING, CATALOGING, STANDARDIZATION, TRAINING, OPERATION, MAINTENANCE, REPAIR, & EMERGENCY RE-MANUFACTURING.

TECHNICAL DATA MANAGEMENT

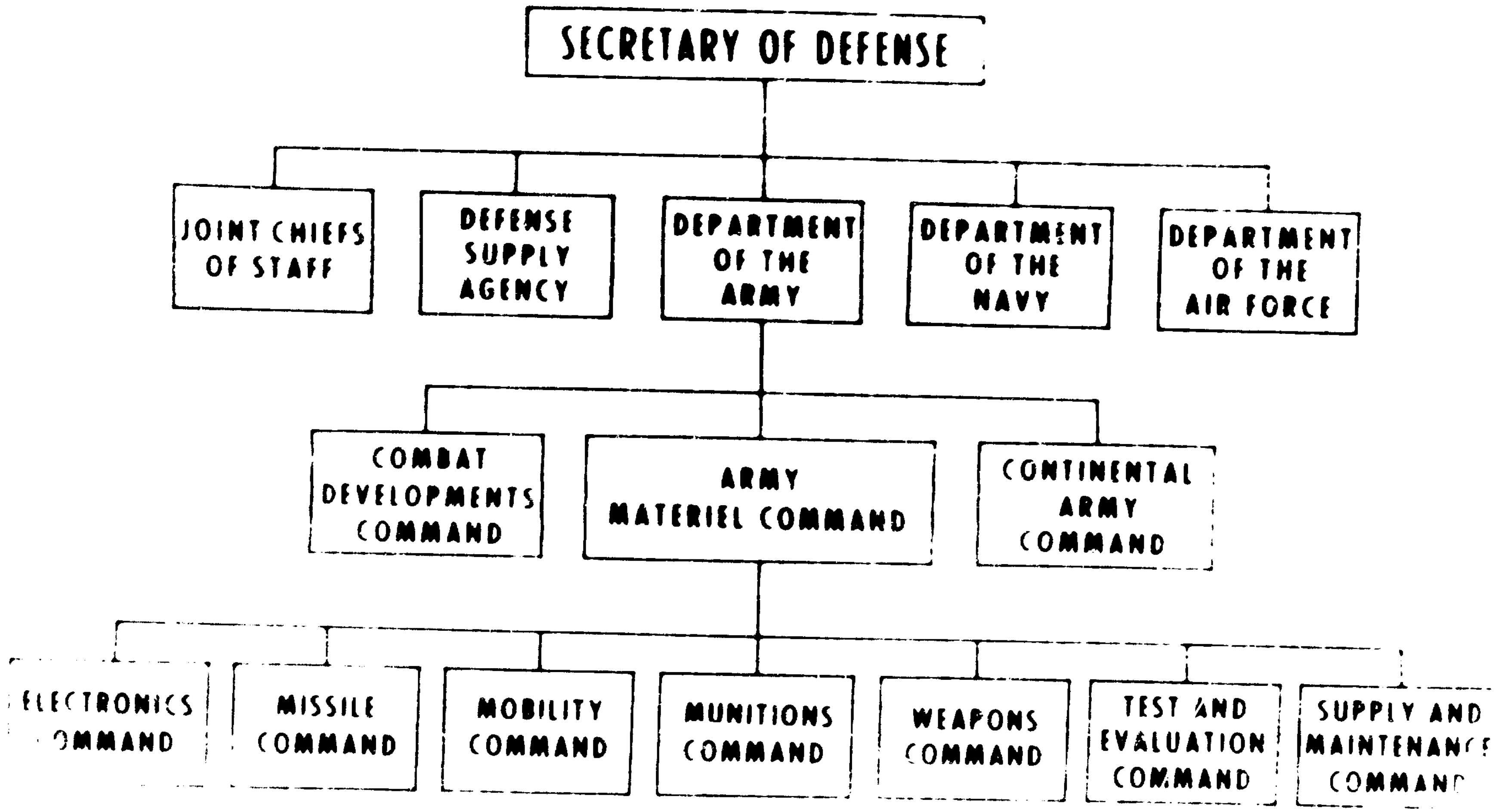
- COST
- DUPLICATION $\longrightarrow$ **CONCLUSION**
- LEAD TIME

Slide #4a

WE MUST MANAGE OUR TECHNICAL DATA WITH THE SAME CARE THAT WE MANAGE OUR MATERIEL, MANPOWER, AND FINANCIAL RESOURCES.

Slide #4b

U. S. ARMY MATERIEL COMMAND



Slide #5

commodity commands, because each deals with a distinct class of commodities: Electronic systems and equipment, missiles, transport, munitions, and weapons. Each commodity command is responsible for the integrated commodity management of items assigned to it. This includes everything from research, to design, development and modification, logistics support planning, product engineering, cataloging and standardization, procurement and production, inventory management, and maintenance. The Test and Evaluation Command performs independent evaluations, through engineering and service tests of materiel, for the five commodity commands. The Supply and Maintenance Command exercises primary Army Materiel Command staff responsibility in the area of supply, maintenance, transportation, integrated materiel inventory management for secondary items, and management of petroleum logistics.

The Army Materiel Command's materiel procurement program amounts to

Slide #6 - an annual buy in excess of 4 billion dollars, which according to some estimates, could run the technical logistics data costs to over ½ billion dollars. This represents the lion's share of the total Army materiel procurement program. Based on this fact, it is not difficult to see why the responsibility for technical data management, Army-wide, was assigned to the Army Materiel Command.

My office, the Technical Data Office, reports directly to the Commanding General, Army Materiel Command, and has staff responsibility for the implementation, Army-wide, of two DOD Programs: The Standardization Program, and the Technical Logistics Data and Information Program. It also has responsibility for the implementation throughout the Army Materiel Command of the Scientific and Technical Information Program and Configuration Management.

Looking at these programs, one might get the impression that they are discrete, autonomous, unrelated programs, when in reality, they are somewhat overlapping, and mutually supporting in my respects.

Slide #7 - In fact, they may best be considered as one continuous program applying to different aspects of data management functions during the life-cycle of a military weapon or system, as it proceeds from the research stage to design, development, production, and maintenance.

In the research area, the Scientific and Technical Information Program (STINFO) furnishes the broad range of studies, data, and information to scientists and engineers in support of their scientific and technical activities. However, as a project reaches the development phase, the collection of data for procurement and production begins and, through development, the feed-back data from production and field use has an increasing impact on the entire technical data program.

The Technical Logistics Data and Information (TLDI) and Standardization Programs are mutually supporting programs. They both deal with the same technical data documentation, TLDI, from the technical data determination and management standpoint, and Standardization from the aspect of the criteria and standards that will reduce the quantity of technical documentation and the materiel it covers.

Configuration management is a discipline usually applied at the initiation of full scale development, and continuing throughout the life cycle, to assure compatibility of hardware with the technical data.

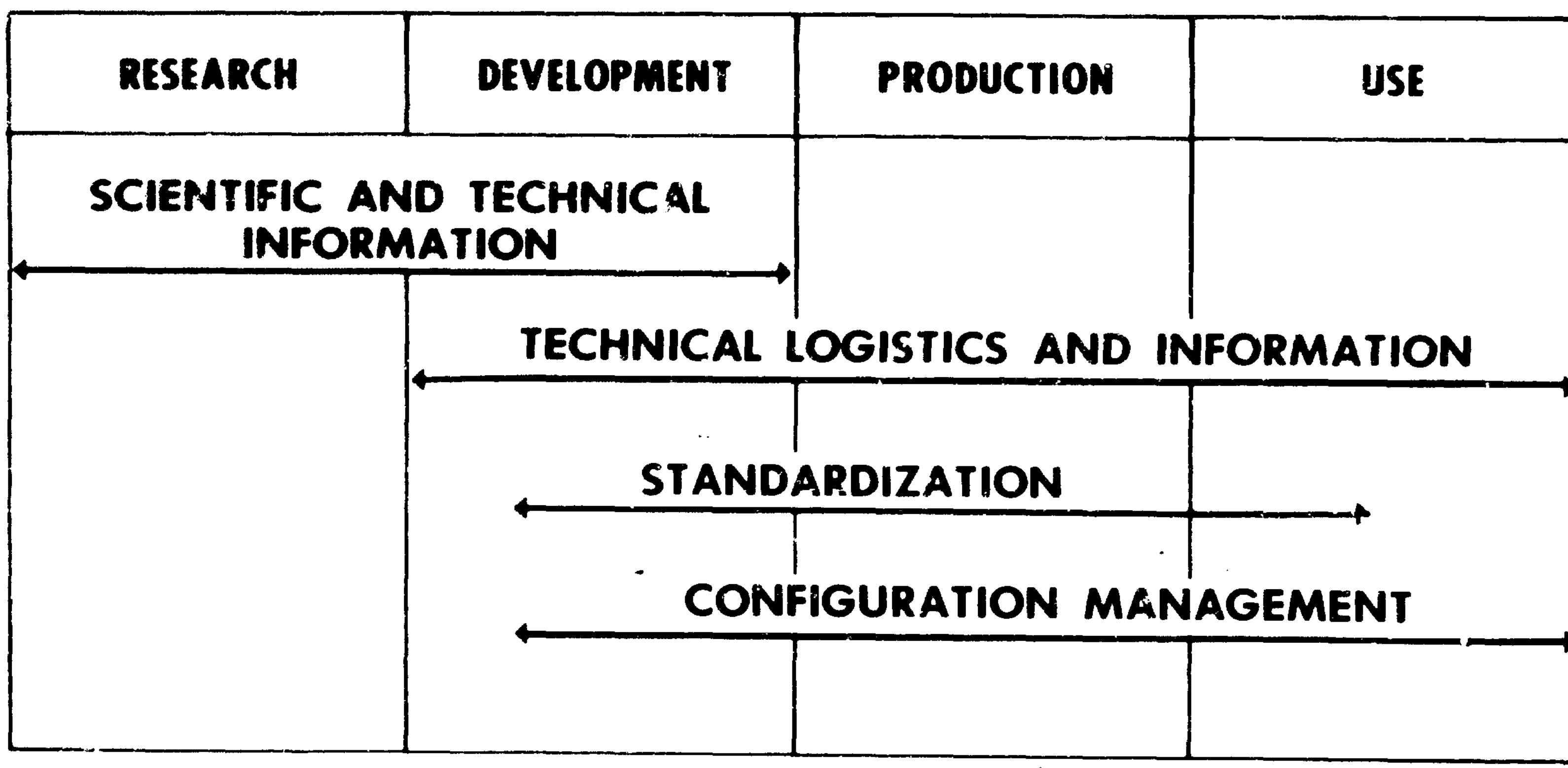
Accordingly, within AMC, we have recognized that the improvement of the quality and efficiency in handling technical data is an "across-the-board" management function.

TECHNICAL DATA MANAGEMENT PROGRAM

- **ANNUAL PROCUREMENT:** 4 BILLION DOLLARS
- **COST OF DATA:** ½ BILLION DOLLARS
- **ARMY-WIDE RESPONSIBILITY**
  - DOD STANDARDIZATION
  - DOD TECHNICAL DATA & LOGISTICS INFORMATION
- **COMMAND-WIDE RESPONSIBILITY**
  - DOD SCIENTIFIC AND TECHNICAL INFORMATION

TECHNICAL DATA MANAGEMENT

MATERIEL LIFE CYCLE



The process of developing an integrated approach to technical data management presented a number of interesting problems in management improvement. As I explained before, our AMC organization was made up of most of the elements of the old Army Technical Services, and at times, consideration of technical data problems had somewhat the flavor of a United Nations meeting in which at least seven different languages were spoken. It was necessary to translate these diverse languages into some sort of a "common" language, or at least, provide our subordinate commands with a standard frame of reference, allowing sufficient flexibility to accomodate their different operating modes.

Slide #8 - The current AMC technical data management improvement program attacks the technical data problem from two angles: one, developing standardized formats, through the use of our Authorized Data List and the Standardization program, and two, improving communications channels through the use of the latest electronic data processing and microfilming techniques.

We are now firmly committed to the principle that any technical data management system, in order to be successful and efficient, must integrate all technical data programs in both the Research and Development and the Logistics areas. And that is precisely why a Technical Data Office was established at Army Materiel Command Headquarters in April 1964.

The organization of our Technical Data Office is shown on this chart.

Slide #9 - We are authorized seven personnel for our Standardization Division, five for our Data Management Division, and five for our Configuration Management Division. Of course, there is in addition, myself, my Deputy and our Secretary. This brings our total manpower resources to 20 personnel; 2 executive, 13 technical and supervisory, and five clerical.

A few moments ago, I explained that my office has Army-wide staff responsibility for the implementation of the Defense Standardization Program, and the DOD Technical Logistics Data and Information Program. In connection with these two programs, I really wear two hats. One as the Army Materiel Command Staff Officer, and the other as the Army representative on the DOD Technical Data and Standardization Policy Committee that Col. Griffith talked about earlier this morning.

In order to carry out our staff responsibility to develop and implement an integrated Technical Data Management Program, we have to maintain close liaison with a number of other Directorates and Offices at our Headquarters, such as Research & Development, Procurement & Production, Data Systems, and Quality Assurance, to mention but a few; and in addition with elements of the DA Staff, primarily the Assistant Secretaries of the Army for Installations and Logistics and Research and Development, to assure that we properly reflect Army Staff thinking.

Within our Major Subordinate Commands, the organizational picture is quite different:

Slide #10 - You will note on this slide that two of our Major Subordinate Commands, the Electronics and Missile Commands, have established Technical Data Committees to integrate their technical data functions. In each case, the Committee is headed by the Chief Engineer, and the executive secretary is from the Management Science - Data Systems Office. The other members of the Committee are high level representatives of the Research & Development, Procurement & Production, and other interested Directorates and Offices. When I speak of high level representatives,

TECHNICAL DATA MANAGEMENT

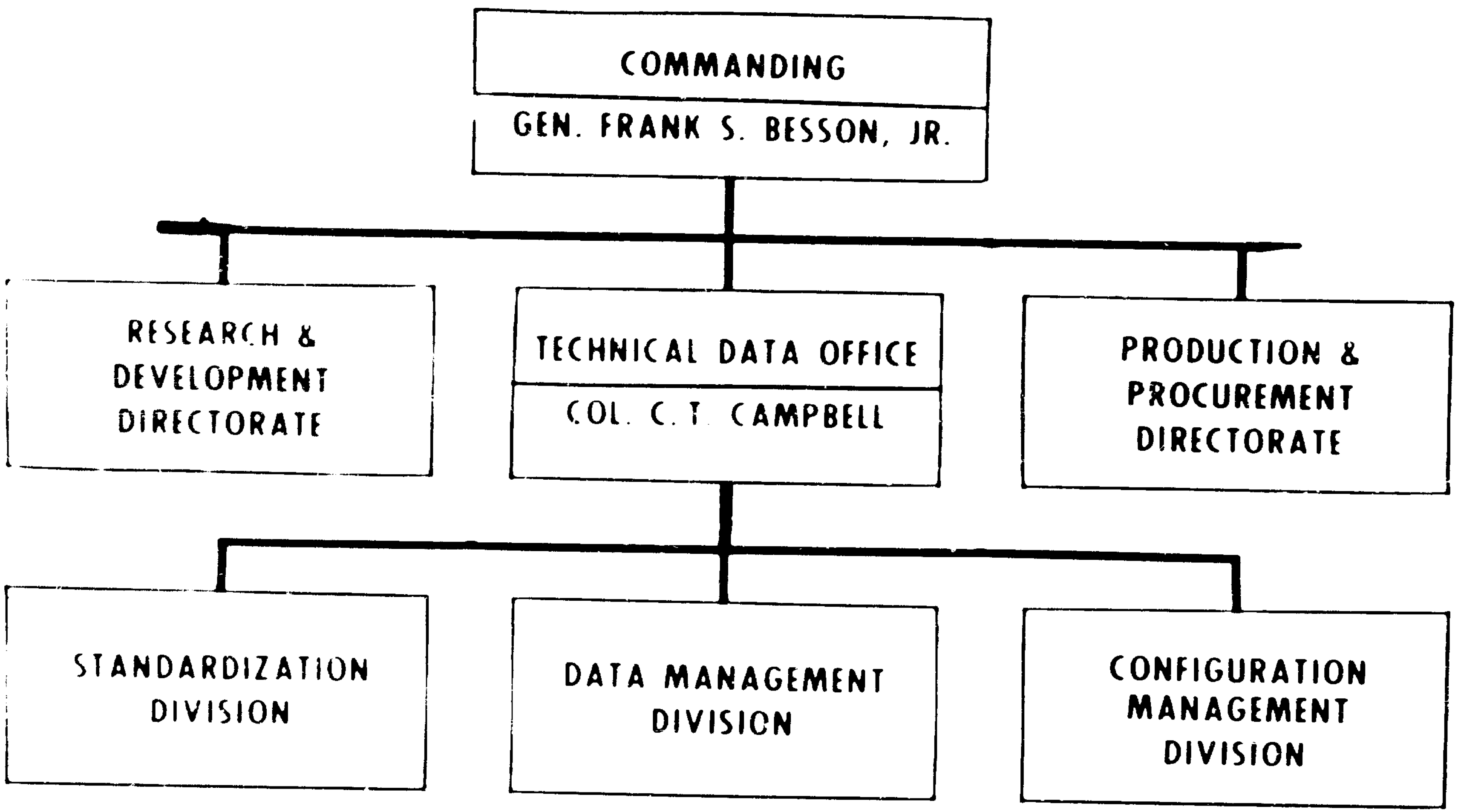
PROBLEM

ATTACK

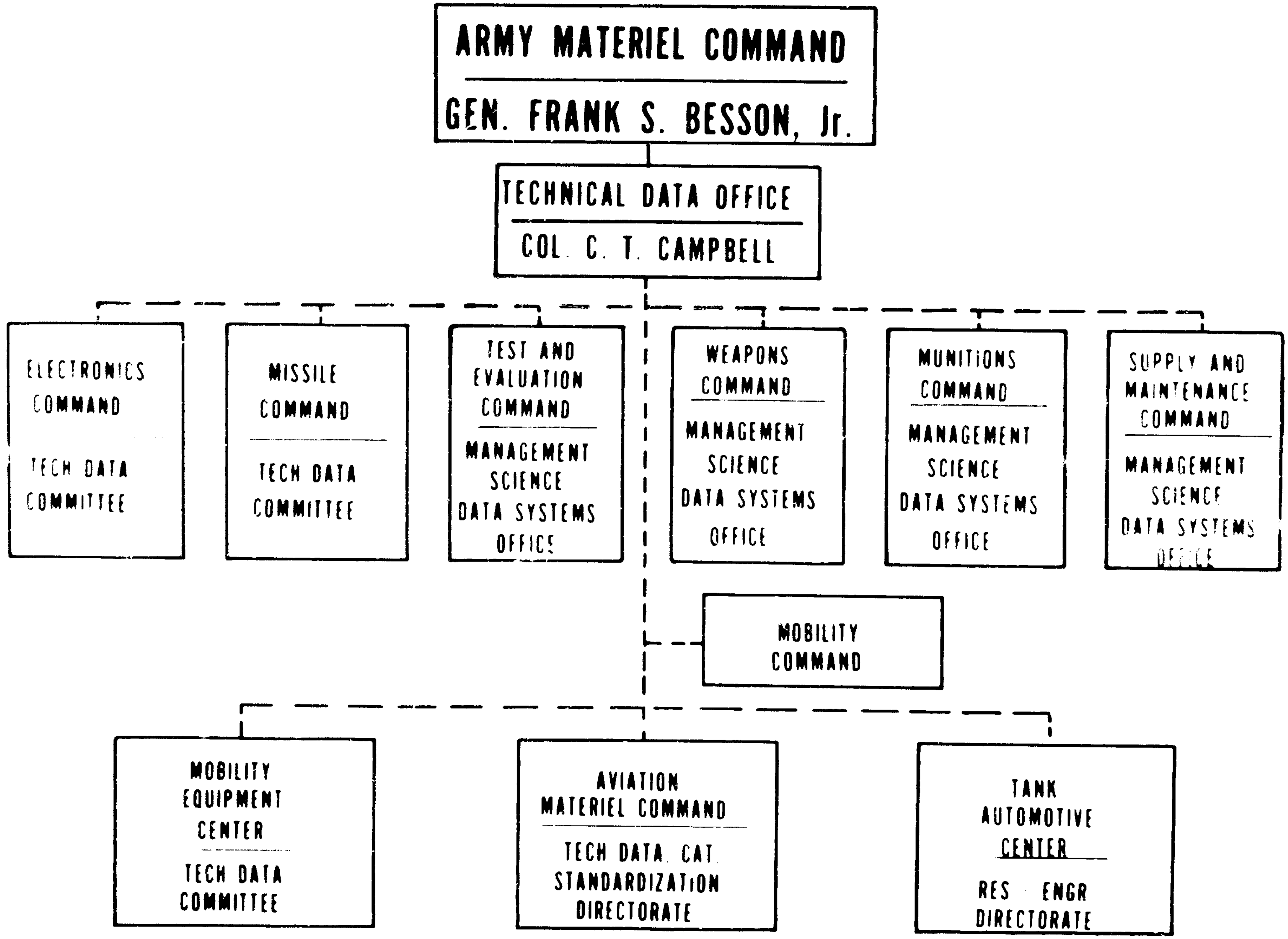
STANDARDIZATION OF FORMATS

IMPROVEMENT OF COMMUNICATION

ORGANIZATION FOR INTEGRATED TECHNICAL DATA MANAGEMENT



Slide #9



D2-13

Slide #10

I am referring to individuals who, by virtue of their position and stature, are able to speak for their organizational element authoritatively.

Slide #11 - At the Missile Command, for example, the Technical Data Committee is headed by the Chief Engineer. The other members are the deputy Director of Procurement and Production, the Scientific and Engineering Assistant of the Research and Development Directorate, the Chief Scientist, and the Deputy Director of the Supply and Maintenance Directorate. The Committee meets quarterly, or at the call of the Chairman. Presentations are made on all phases of technical data management: progress in on-going projects is discussed, problem areas are brought to the open for solution, new developments in the technical data area are presented, new policies from higher headquarters and methods for their effective implementation are discussed. There is tremendous interaction between Committee members. When you leave one of these meetings, you cannot help but be impressed with the fact that not only are the members really knowledgeable of what is going on, but that they are working as a first-class team. Cooperation, not squabbling, is the keynote. Positive action, not idle talk, is the outcome.

Slide #10 - Four of our Major Subordinate Commands, have placed the Technical Data Management function in their Management Science - Data systems Office. Time does not permit me to discuss in detail the various methods used to integrate technical data management in each of these commands. Essentially, integration is achieved through the use of committees and steering groups operating essentially like the committee I just described. Some are quite elaborate, involving not only Headquarters personnel, but representatives of their subordinate installations.

Organization for Technical Data Management, within installation and activities reporting directly to Army Materiel Command Headquarters, varies considerably. Suffice it to say that as a minimum all have established a focal point within their organization to insure coordination of their technical data functions and activities.

You must be wondering about why we have this diversity in organization. From the beginning, about a year and a half ago, when our subordinate commands and separate installations were told to integrate their technical data management activities, we allowed for flexibility in organization to accommodate their different modes of operation and the manpower and other resources available to them. Experience has proven us right. Without exception all of our subordinate organizations are operating efficiently and effectively. They have integrated their technical data functions. They have reduced duplication and overlapping of effect, and, above all, they have subscribed to the basic principle I enunciated at the beginning of my presentation: that

Slide #12 - we must manage our technical data resources with the same care that we manage our materiel, manpower and financial resources.

TECHNICAL DATA COMMITTEE

- COMPOSITION
  - Chairman
  - Members
  - Executive Secretary
- OPERATION

TECHNICAL DATA MANAGEMENT AND HANDLING

WE MUST MANAGE OUR TECHNICAL DATA RESOURCES WITH THE SAME CARE THAT WE MANAGE OUR MATERIEL, MANPOWER, AND FINANCIAL RESOURCES.

Slide #12

DATA MANAGEMENT FOR DECISION MAKING $(DM)^2$

Lt. Colonel William O. Rennhack
Acting Chief, Systems Criteria Division
Directorate of Systems Policy
DCS/Systems

It is a pleasure to address the Engineering Documentation Section of the American Ordnance Association on the Eighth Annual Meeting. It is a challenge to tell you something new in technical data and documentation. I thought the presentation I gave to the AFSC System Program Directors in April 1966 would give you the other side of the coin as a program director sees data products for decision making.

While most of you are interested in data products and engineering documentation, I am sure that you all realize that one of the greatest challenges in management is the job of the System Program Director or the project manager. He is confronted with immense responsibility. He must optimize taxpayers' dollars spent in the acquisition of hardware. He must effectively utilize the human resources entrusted to him and lastly insure that the requirement for hardware is met in terms of scheduled delivery. These responsibilities for program management are equally true in the contractors' plants in the office of the project director. Instead of taxpayers' dollars, however, it is stockholders' equity which must be enhanced with a profit shown for the contract.

Decision making by the project director occurs during the life span of the program. Decision making is normally based on experience and judgment, but in addition some kind of objective feedback process must be developed to enable a project director to make good decisions with alternatives and risks evaluated.

While the data management program was essentially developed to reduce the minutiae of functional data requirements placed on contract, there are many side effects which have direct concern to the program director. For example, the objective feedback which is necessary from the contractor can be channeled to the attention of the director to enable him to know the status of his contract and the utilization of resources. Thus, the System Program Director has two fundamental problems; deciding what tasks should be accomplished, and defining what data should be placed on contract for feedback control. It is this latter control which gives objective analysis.

Management theories state that decisions must be based on facts; therefore, data becomes exceedingly important in the management scheme of things. If good facts are not readily available, other kinds of management may merge such as management by exception. Management by exception, however, infers that an analytical appraisal be made to determine when areas fall out of tolerances. Using this technique, more management effort is expended when problems fall out of anticipated areas. Data is a vital part of the decision making process when used properly under management by exception.

The squeaking wheel concept of management infers that the program director is willing to take a calculated risk; that no action is necessary until a problem arises. This kind of management requires no feedback data and no action is taken until slippages occur in delivery or overruns of the contract occur.

The therapeutic effect of good data management cannot occur unless it fits into the overall structure of the management system at the program office. Before data management concepts can be effective, the program director must first recognize that gamesmanship and strategy are responsibilities of the first order of magnitude. Secondly, that a management flow structure such as PERT charts are needed to chronologically appraise progress. And lastly, that baseline controls are used to keep hardware within funds and configuration control. Barriers to decision making can be reduced by a good data management program. The discipline and rigors of having a good Contractor Data Requirement List (CDRL) (DD 1423) forces decisions regarding the total integrated package. Tasks must be divorced from data and placed into the proper order in the work statement. Data management becomes a forcing function on the overall management structure. It eliminates many redundant overlapping and conflicting instructions and directives. Visibility is given to the myraid data elements making up the management system.

Data Management in accordance with AFR 310-1 is a simple common-sense approach to solve chronic problems. The clear concept is that no data are to be prepared by the contractor or delivered to the Government unless it serves a specific need to the program director. Decisions as to what data should flow from the contractor to the Government is necessary. Data should not flow to Government sources where decisions should not be made by engineers for design approval under a fixed-price contract. Stopping the flow of unnecessary data is equally as important as having the flow of data to the proper office.

Functional staff offices are also generators of data and cross all contract levels in their zeal for information from the contractor. Since the payment for this data has to be made from hardware appropriations the program director cannot be put in a position of automatically getting data to satisfy this requirement. Logistic data, engineering drawings, specifications, and test reports must all come under the scrutiny of its value and utility to the one man running the program. There are no automatic data requirements which must be placed unilaterally on all contracts. Judgment, evaluation, and cost trade-offs must be used in all cases. This is a severe burden, for it is easier to say yes than no. Criteria for establishing data requirements are not readily available, but the concept to start with nothing and build up a DD 1423 is fundamentally sound. Another less desirable technique for the establishment of data requirements is to start off with a maximum list of all data possible and scratch off those considered unnecessary. Data should be based upon need and justified in accordingly, not automatically considered necessary to satisfy across-the-board requirement for all contracts.

Experience has shown that in many cases data has arrived too late to meet the decision that has to be made. The DD 1423 forces the contractor to make deliveries of the data products in accordance with contractual terms and gives the Air Force a tool to insure its timely delivery. The data management program offers the program director better decision making capability by clearly establishing a need for the data and placing it one place on the contract giving visibility to other disciplines, forcing the contractor to give timely and adequate data.

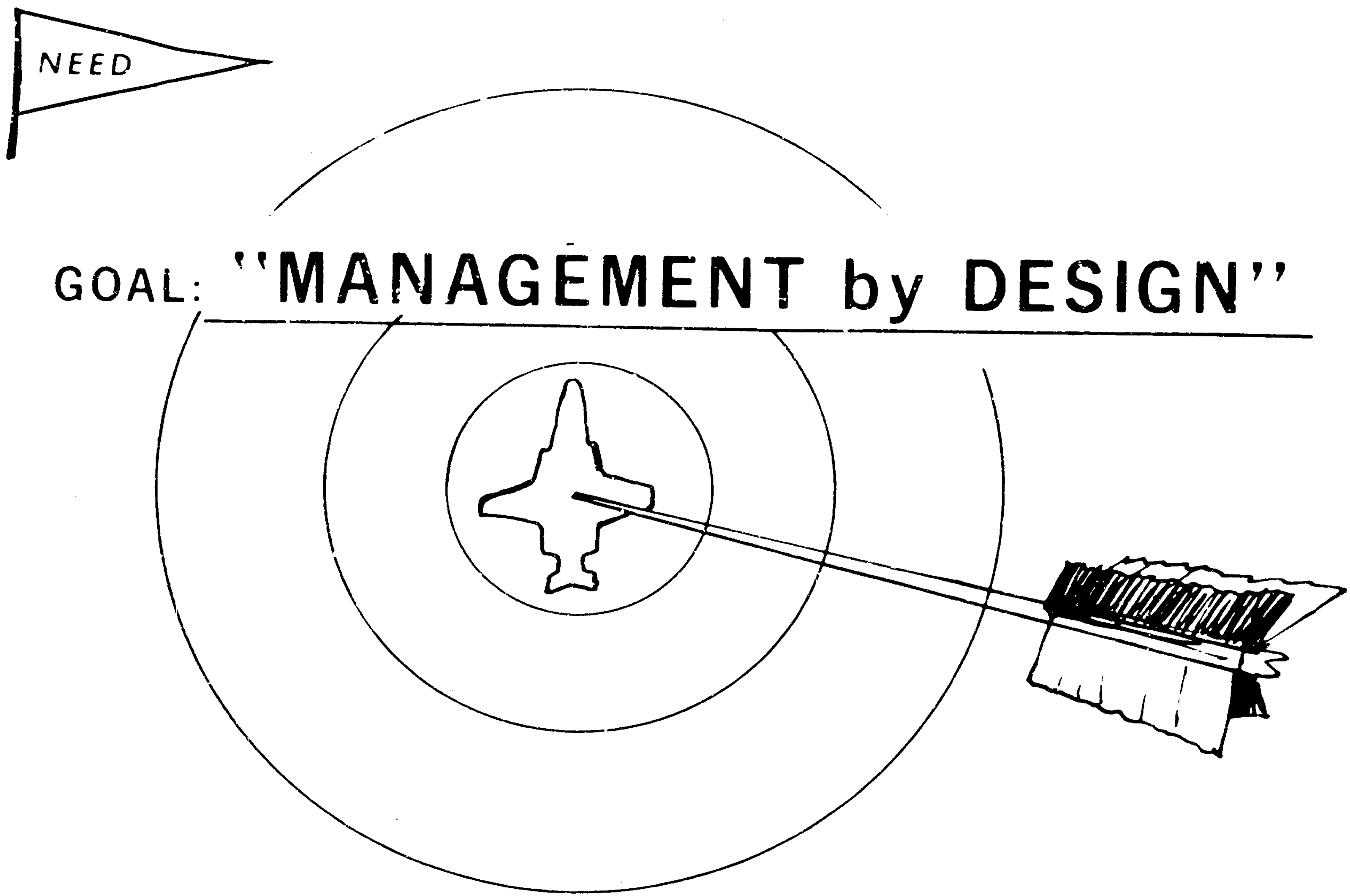
The Government project director is faced with the difficult task of placing all requirements on a fixed-price contract structure which assumes that no changes are ever made to the system. However, changes are a normal way of life. In the real world changes are so prevalent that it is almost impossible to keep up with them. In order to cope with this problem AFSCM 375-1, "Configuration Management", has been developed. Baselines are established to control configuration in order to get repeatability on a system.

The Defense Department is on the threshold of developing new theories of doing business. Increased use of fixed-price contracts, multi-year buys, and contractor definition phase are some examples. The contractor definition phase, in accordance with DoD Directive 3200.9, forces decisions at an early point in the life cycle of systems acquisition. So early in fact, that some people have called CDP "off-the-shelf procurement" of a system not yet designed. Since decisions must be made extremely early in the total life cycle, data must likewise be developed for decision making. This was particularly difficult under the C-5A program.

Data management must be responsive, however, to the management structure which implements these new techniques. Indeed data management may very well be a common denominator giving visibility and understanding to the management structure.

During a data call a comprehensive analysis of each data item gives insight to the structure much like a circuit diagram gives integrity to a piece of electronic gear. Since decision making must have current, accurate data to allow the program director to properly manage his program, data management is essential to give him the factual information necessary to support his program. At the recent data management symposium at Beverly Hills, September 1965, General Schriever made the statement: "Decisions are the basis of management and data are the basis of decisions." It is this quotation from General Schriever which caused the preparation of this briefing.

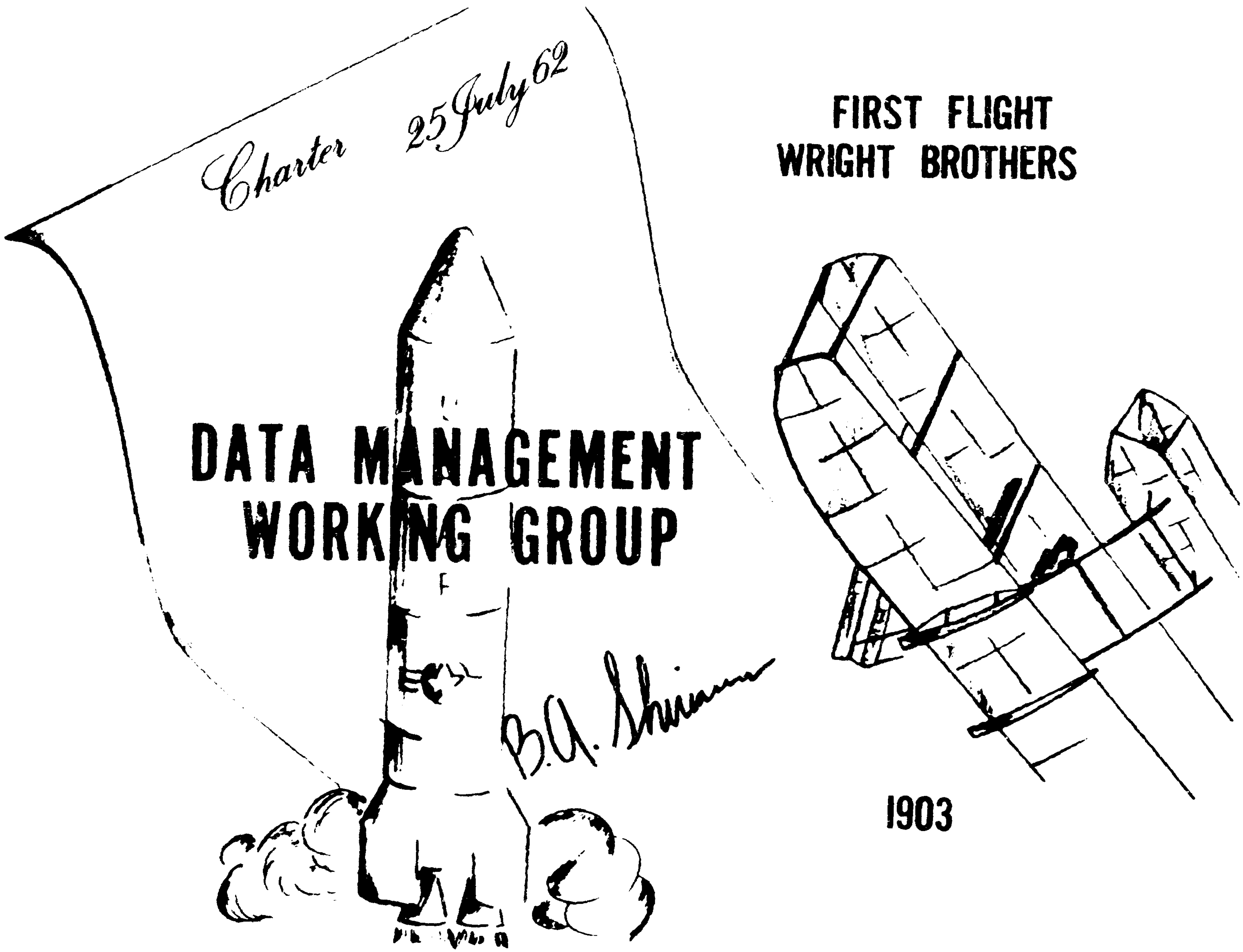
In conclusion, data management will save dollars for hardware acquisition, save resources from unnecessary storage and retrieval of data, free the decision making process from minutiae of unwanted information and force timely decisions. The defense posture of the free word to an appreciable extent is based upon decisions made by program managers.


NEED
GOAL: "MANAGEMENT by DESIGN"

APPROACH

ELIMINATE BARRIERS TO DECISION MAKING

- RECOGNIZE GAMESMANSHIP/STRATEGY
- MANAGEMENT FLOW STRUCTURE
- BASE LINE CONTROL
- COMMUNICATION CONTROL / DATA MANAGEMENT


Charter 25 July 62
DATA MANAGEMENT
WORKING GROUP
B.A. Shinn
FIRST FLIGHT
WRIGHT BROTHERS
1903

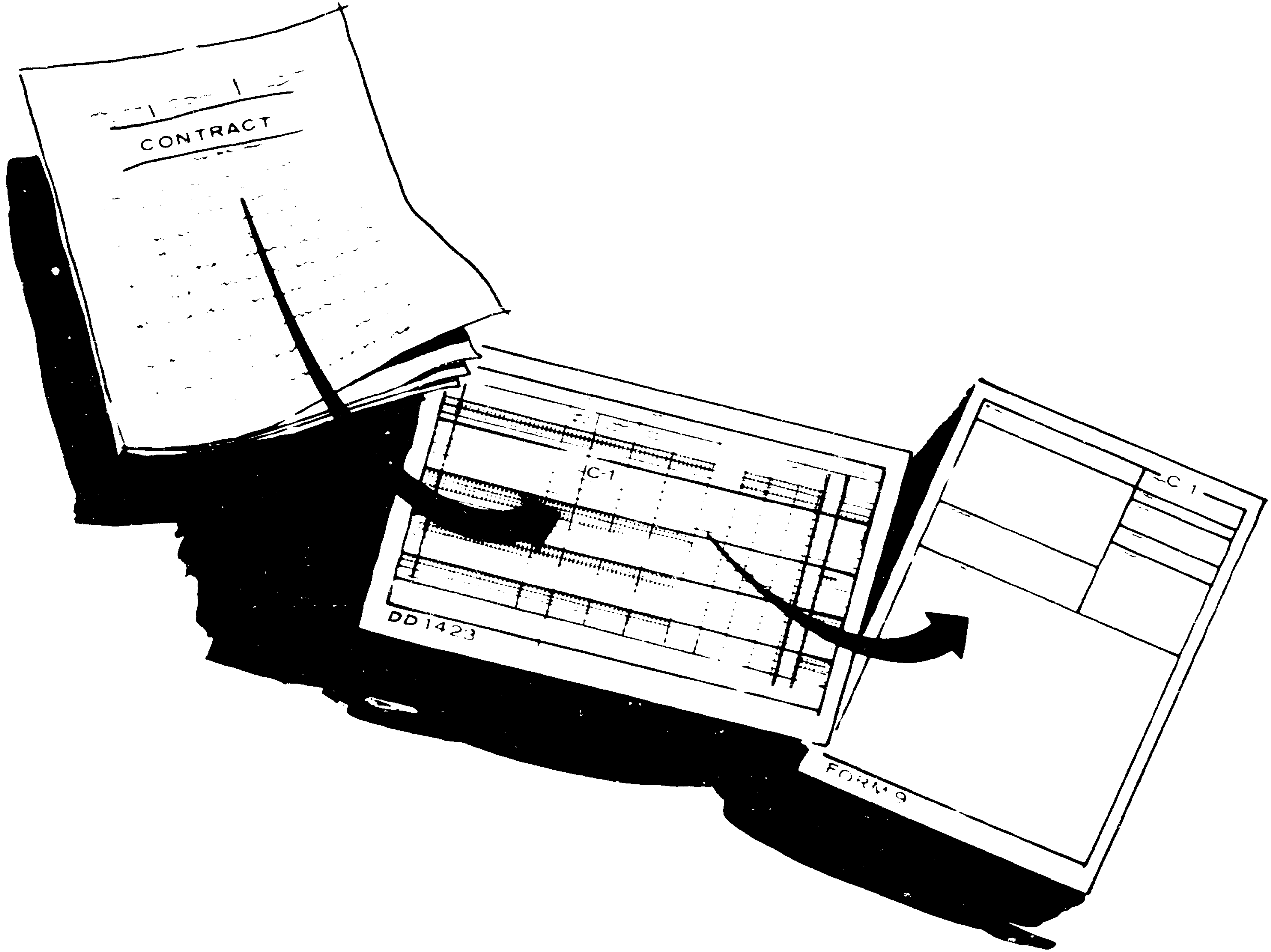
310-1

COMMON SENSE APPROACH

Tailor Data to Need

List on DD-1423

Management Tool


CONTRACT
C-1
DD 1423
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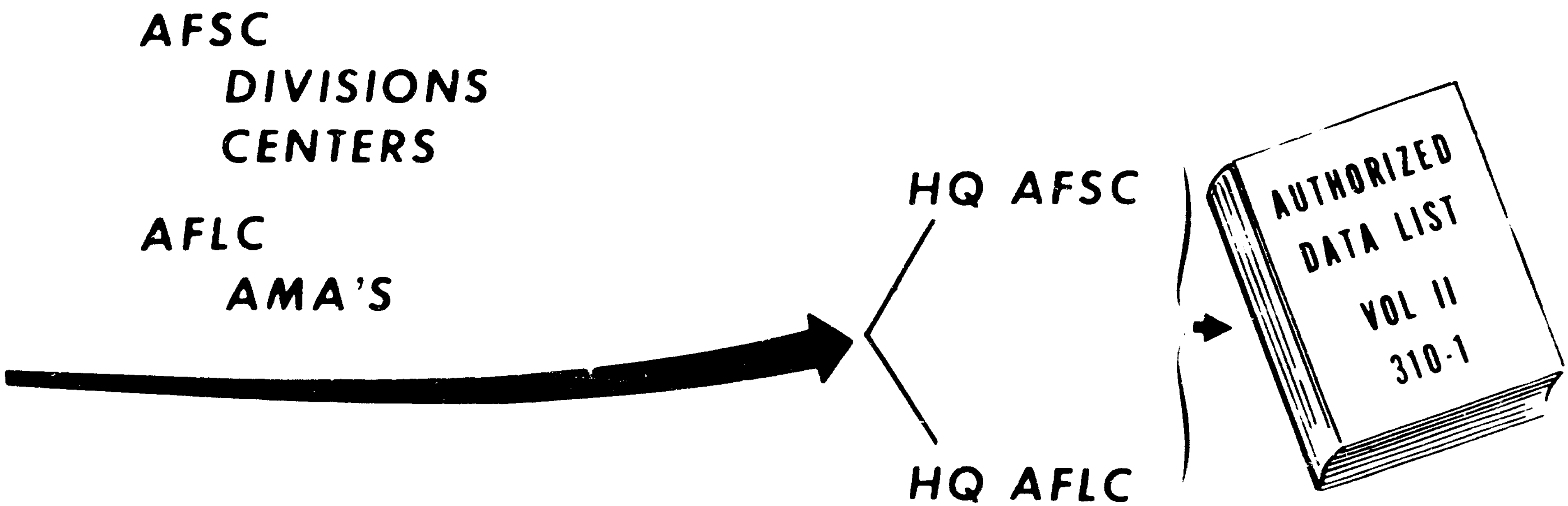
FORM 9

DATA GENERATION OF U ITEMS



DATA CALL DD1423 REVIEW CONTRACT PLACEMENT

AUTHORIZED DATA LIST

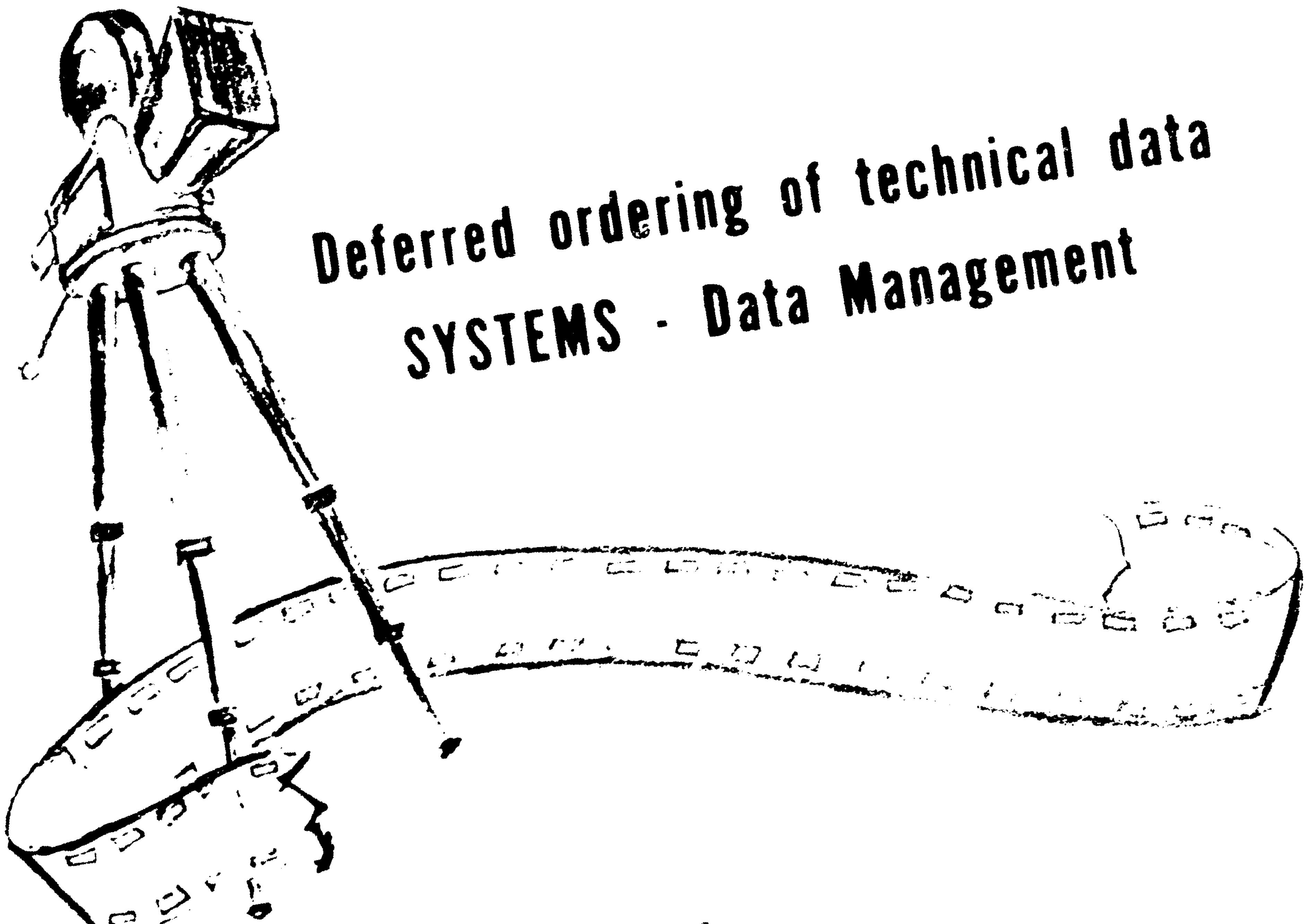
NUMBER OF ITEMS

	TOTAL
BASIC	231
REVISION 'A' +21 ITEMS	252
REVISION 'B' +2 ITEMS	254
REVISION 'C' +8 ITEMS	262
REVISION 'D' +24 ITEMS	286

DEFERRED DELIVERY OF DATA

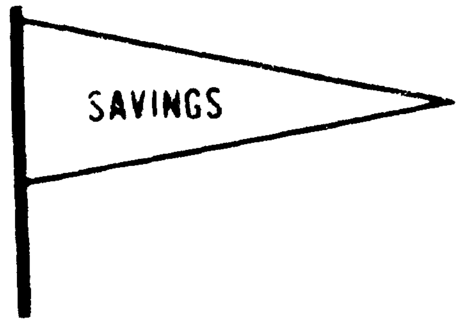
- C-141, C5A LOCKHEED
- F-111 GENERAL DYNAMICS
- J-79 GENERAL ELECTRIC

TECHNIQUE FOR
FORGETTING DATA



Deferred ordering of technical data

SYSTEMS - Data Management



FY 64 - 65

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Audited RESULTS

85 Million

Exceeded goals by 195%

ENGINEERING D .N; KEY TO LOGISTIC SUPPORT

Lt. Colonel Edwin G. Triner, B.S., M.A., M.S., PhD
Systems Management Policy
Air Force Systems Command

Southeast Asia - Followed daily by millions of people throughout the world are the happenings in Southeast Asia. This heretofore cloistered, remote, seemingly benign portion of our globe has been transformed into an area of conflict, political wrangling, and continuous face-to-face combat. As the conflict continues, there will be fewer and fewer Americans who do not have a relation, an associate, a friend, or a neighbor, intimately involved in the strife. South Vietnam is indeed rapidly becoming a personal war. Within the short space of one year, the scope of our activities has significantly changed. All issues of the daily newspapers carry detailed coverage of the day-to-day events in Vietnam. Television news reports highlight the happenings of this combat area. Every radio news broadcast devotes a lion's share of its time to almost hourly reporting of the Vietnam conflict.

Logistics - Highlighted in many of the reports have been the logistics problems impeding the successful employment of our advanced weapon system technology. There is no secret, having been well publicized by our news media, that a serious limitation to our combat effectiveness has been logistics support. Considerable difficulty has been experienced in maintaining and supplying our advanced systems. The problem of maintaining our sophisticated systems, accentuated by the revolutionary advancements in our technology, is becoming more acute day by day. Impacting heavily upon the maintenance of these systems is the supply support required. Without adequate, timely and readily available supplies needed to repair and/or replace inoperative or expended equipment, our sophisticated weaponry rapidly assumes the role of an ornament devoid of operational capability.

Addressing the general problem of supply support, General Schriever has recently stated, and I quote:

> "Fundamental to the successful fielding of sophisticated weapons systems is the capability to operate and logistically support these technological advancements in the operational environment. Any uncontrolled proliferation of new items entering the inventory not justified as advancements in the state-of-the-art has highly deleterious effects upon our defense posture. The task of minimizing the number of new items entering the inventory is the extension of the standardization philosophy back into the research and development stage. A careful balance must constantly be maintained to assure that our effort to encourage the use of existing items and new developments is not pressed to the point where we are stultifying technical progress."

DOD Inventory - The Department of Defense has well over four million line items of supply in its inventory. Each item needs to be administered. Most need to be stocked, stored, delivered, provisioned, engineered, removed, replaced, repaired, etc. The administrative cost alone of each line entry varies from a figure as low as $34.00 to many thousands of dollars. This large variation can be attributed to a sliding definition of what is to be included in the total cost of administering a line entry of supply. The fact remains that our advanced technology is totally dependent upon timely supply of the lowliest nut, bolt and washer as well as the most exotic hardware assembly. This year alone, 173,000 new items were entered into the DOD inventory. Simple arithmetic can provide data on the administrative cost of introducing these new items into the supply system.

Proliferation of the entry of new items into the inventory is not only costly when considering the increased administrative burden, but far more important is the impact upon our nation's security. We simply cannot maintain our equipment in operational condition when the supply support needed increases beyond bounds. For years, the attempt to control the increase of inventory items has been relegated to a supply discipline. And, taken at face validity, there is a certain amount logic which leads to a conclusion that control of a supply inventory is a supply matter.

Sand Bag - Realistically, however, once a hardware design decision is made, any attempt to control by supply action the entry of new items into the inventory is akin to having a single bag of sand stave off the flood waters.

In a recent address to the Joint Economic Committee, Secretary of Defense McNamara commented on this problem by stating:

> "But much more fundamental to the task of minimizing the number of new items entering the inventories than "screening"* is the extension of the standardization philosophy back into the research and development stage. Here is where the decisions are really made to add new items to the supply system and the consequences of these decisions cannot be undone at the supply support stage. Each time a new weapon enters the inventory, it brings with it thousands of new items of spares and support equipment. That is why any serious attempt to reduce the number of different items in our logistics system and thereby reduce logistics cost, must begin in the research and development stage."

*(NOTE: The reference here is to supply screening).

Panel 29 Charter - Panel 29 Mission - General Schriever, fully attuned to the urgency of follow-on logistical support of our advanced systems in acquisition, in concert with General Hobson of Logistics Command, chartered Panel 29 approximately nine months ago. This joint panel was charged with the responsibility to realign the Air Force portion of the Defense Standardization Program to place more emphasis on the engineering and technical aspects of standardization and to provide for the orientation of the program toward the system development and engineering design phases of the life cycle of a weapon system.

It is the specific purpose of this paper to:

a. Disclose the standardization objectives resulting from Panel 29's nine months of effort.

b. Explain how these objectives are being accomplished, and

c. Outline future actions which are in the offing.

Before proceeding, the word standardization needs to be defined for it means many things to many people. Within the context of this paper, standardization will be a means to optimize control over new items entering the Air Force inventory.

Objectives - The objectives of the Systems Command's Standardization Program are twofold - to control the entry of new items into the inventory, and, (contrary to the expressed and implied apprehensions concerning stultification of design creativity), to enhance engineering design through item entry control.

Exhaustive and exhausting detailed discussions and analysis of the myriad problems connected with control of items entering the inventory have resulted in the firm conviction that the entire problem is capable of being divided into three major components. These are:

Standardization Phases

a. Knowing what is available in our inventory, currently being used and projected for future employment.

b. Requiring inventory items to be used to an optimum, notice I did not say maximum, extent.

c. Invoking a disciplined system assuring that the regulations, documents, contractual clauses, envisioned in b., above, are implemented and pursued.

(For the semanticist, when I employ the word "inventory", I include not only the items already contained in our catalogues and/or supply system, but those items which we are committed to supply following approved engineering design released to production.)

Approach - For ease of discussing these above three phases: - knowing what is available, requiring that these items be optimally used, and disciplining the system, - each of these three areas will be divided into two categories - on the one hand, systems, end items and components; and on the other, the next level of indenture, the piece/part area.

Addressing the problem of making known to the design agency what is currently available down to and including the component level, there currently exists the DoD Index of Specifications and Standards, industrial association standards, various other manuals and catalogues. Unfortunately, a large portion of this information is generally three to five years old. At present, there exists no system to make available, for example, to the FX System Program Office (SPO) - which might be in the feasibility phase of development - that which is currently accepted for use in the F-111 acquisition system. There is normally a three to five year delay until the specifications describing items being purchase on a new system coming into acquisition are updated and distributed for widespread use. Yet, realistically, the most important information, the most timely, the information which most includes advancement in the state-of-the-art is that design requirement and design solution information which is currently being developed on active acquisition type of system programs.

Items Available - I will present later in this paper specific changes to AFSCM 375-1 necessary to assure the availability of information to design agencies. In addition, details will be discussed of the operational plan for the employment of the Defense Documentation Center (DDC) for indexing, printing and distributing the specifications describing the components being introduced into our new systems under acquisition prepared by weapon systems contractors in accordance with procedures contained in AFSCM 375-1.

When viewing the piece/part problem, the solution varies considerably from the way we can control information availability at component level. It is envisioned that the Industrial Associations will be looked to, to assume a large share of the responsibility for developing Industrial Association specifications for piece/parts to be used in engineering design. The specific details of this proposal will be addressed before the end of this paper.

While significant data supporting the development of new piece/parts are generally contained in specifications, a readily available source of information on existing items in our inventory is contained in catalogues. This cataloguing information must be readily available to the design agency in a form which facilitates search by performance characteristics.

Once the design agency knows what has already been developed: through the exercise of the indexing scheme by the Defense Documentation Center for the 375-1 component specifications; the accelerated development of piece/part specifications by the Industrial Associations; and cataloguing of parts made available to design agencies by performance characteristics, the next step is to require design agencies to optimize the use of these known parts and components. There are three major phases within the life cycle of a weapon system at which controlling documentation is needed to assure optimum employment of known components and parts. These three phases are the Conceptual Phase, the Definition Phase and the Acquisition Phase.

Conceptual Phase - It is during the Conceptual Phase that care must be taken to assure that controls do not in any way inhibit design creativity. On the other hand, it is to the ultimate good of the design agency to create an early awareness of the importance of employing, where feasible, inventory items. In many instances, decisions made during this very early phase of a life cycle directly result in the kind of hardware which is subsequently manufactured. An example of this is the V/STOL aircraft currently in Advanced Development. Advanced Development Directive 44 directs six contractors to perform a technical feasibility study of the V/STOL aircraft. The technical feasibility in this instance is being demonstrated by most, if not all, of the six contractors by actual prototype models. It is safe to assume that the products developed at this early stage of the life cycle will profoundly influence final design. Conceptual Phase contracts should include, when applicable, an indication that consideration will be given further on downstream to design which optimizes the use of inventory components and parts.

Definition Phase - During the Definition Phase, the Request for Proposal (RFP) for Phase IB Contract must contain information to the prospective contractors that source selection will assess the extent to which inventory components are to be used in fulfilling design requirements. Particularly on a Fixed-Price Contract, the emphasis on Source Selection as well as the cost savings accrued through minimizing requirements for new design will be a motivating influence upon the contractor. Each standard component used has significant impact on minimizing the number of new parts entering the inventory for each component is comprised of many hundreds of parts which would not have to be additionally provisioned.

Acquisition Phase - The contract for the Phase II Acquisition Program must include an Incentive Clause for minimizing the number of peculiar parts which go into building each of the components. The development of appropriate contract clauses must be accomplished fully cognizant of the fact that selective application of these provisions needs to be provided. It must be recognized that within each system there are certain components which require constant improvement and advancement of the state-of-the-art. Certainly, an Incentive Clause for minimizi new items in this area would preclude the very advancement for which we strive. On the other hand, the preponderance of components within a system simply have to meet performance requirements. In this case, incentive features to meet performance requirements employing the parts already in our inventory would have significant value.

Optimum Use

This, then, is the second of the three phases.

As you recall, knowing what was available by the design agency was the first major point. Requiring that standard items are used to the optimum extent was the second point. This we proposed to do by selective documentation at the three phases of the life cycle of a weapon system. Finally, the key to success of any program is the method of enforcement.

Disciplinary Force - It is envisioned that the controlling force necessary to guide this program will be led by a small group at Headquarters Systems Command acting as the focal point for the Command. This focal point will be responsible to establish policy guidance, review the Product Division implementation procedures, assign and supervise standardization tasks, promote interservice standardization, as well as international standardization.

Within the Systems Command, each of the four Product Divisions will have a Standardization Engineering Analysis Group (SEAG) comprised of somewhere in the vicinity of 10 to 12 people. Each SEAG will have the responsibility for supporting all SPOs within each Division; developing component and piece/parts lists; negotiating with contractor standardization personnel in advance of contract definitization the Component and Parts Lists to be employed in the execution of each contract; and coordinating with the Industrial Association's military liaison personnel to determine what the latest state-of-the-art is as well as to provide tasks to which these associations would address themselves. This group will be able to render considerable support to the SPO. Most contractors have indicated very positively that, if they had specifications readily available to assist in their design process, it would cut down significantly on the amount of lost time and motion they now expend in attempting to ferret out the existing military specifications. This group will also provide for inter-systems standardization by being sufficiently knowledgeable of what is being procured on one system that has applicability to a follow-on system.

Within each SPO, there will be at least one individual assigned the responsibility of Standardization Engineer. He will be the SPO focal point for standardization, provide direct supervision of contractual compliance by the contractor, introduce to the contract all of the appropriate standardization directives, and be the liaison between contractors and government standardization people.

The Air Force Logistics Command is also assessing the contribution it can make in the SPO climate to provide for more direct tie-in between the SPO and System Support Manager (SSM).

In addition to the Systems Command Headquarters, Divisions and SPO organizations, a group of highly qualified Standardization Engineers working directly with the Industrial Association standardization teams will be organized. Their specific role will be discussed later.

Slide - F-111 Avionics

Slide - F-111 Electronics

The F-111 is a fine example of what can be accomplished with a few knowledgeable people pressing the advantage of minimizing the number of unnecessary new parts entering the inventory. From approximately 220,000 non-standard parts in the electronics category that would have appeared on contractor drawings, the number of nonstandard items was reduced by approximately 75 percent. This was accomplished by aggressive effort to develop standard, acceptable, reliable piece/parts.

Slide - Road Map

This, then, is the Road Map for Standardization in accordance with the systems management concepts.

Briefly reviewing, we have first the necessity of providing to design agencies a knowledge of that which is contained within the Air Force inventory. Once this is accomplished, the requirement will be established for the contractors to optimize the use of standard parts through Conceptual, Definition and Acquisition Phases of the life cycle. And, most importantly, a discipline will be phased in to assure continuity and control.

Let us go back for a moment to focus upon the specific aspects of this program which have most significance. A detailed review of the best method for new acquisitions to assure that design requirement information for components is made readily available to future design agencies clearly indicated the employment of DDC facilities.

DDC - The DDC charter requires that it be the central repository for technology and research reports; test reports on subsystems, components, parts, etc. Relating this to the systems life cycle, DDC is actively pursuing its role at the very earliest phases by handling basic and advanced research reports and then again considerably later during testing phases.

Design requirements as well as design solutions for subsystems, components, etc. is that portion well within the DDC charter that to date is not being exercised. Preliminary investigation with Dr. Stegmaier, the Director of DDC, indicates that he certainly envisions the requirement to perform this service.

Slide - DDC Flow

The flow will look something like this. Design requirements documents, including abstracts, will initially be prepared by the contractor. These requirements will be approved by the SPO. The approved design requirement and abstract will be forwarded to DDC. DDC will then enter the abstracts into the data banks and design requirements into the library of reports. The Government Printing Office will publish the Technical Abstract Bulletin (TAB) and distribute to the addressees provided by DDC. In addition, the DDC will provide service for anyone requesting information if they are entitled to the service. From the time that the DDC receives the design requirement document and abstract, they will have it distributed to design agencies within 25 working days.

Slide - DDC Documentation Processing

Once the design agency finds something in the TAB that it needs, it prepares a request for the document and sends it to the DDC. The DDC enters the requisition into the data system, and if they have the document on their shelf, it will be mailed out to the requiring agency within three days. If they do not have it on the shelf, and have to reproduce, it will take seven days from the time they receive the requisition. This is the normal DDC procedure. There is no reason to request special handling for the design requirement documentation.

From the contractor's point of view, our investigation discloses that most of the prime contractors review conscientiously the existing TAB today. Including the design requirements information within the TAB would impose no change to prime contractor's normal procedure, but would significantly augment the information that is available to them. Design information would be readily at hand to assist in their engineering design development.

Addressing the problem of making available the information on piece/parts, it is envisioned that the industrial community, resulting from renewed interest and close liaison with Air Force representatives, will be encouraged to accelerate their productivity in the development of specifications and standards. Industry constantly prepares specifications and standards on utility parts which, in reality, parallels the effort of the Air Force. It is not only feasible, but highly desirable that the Air Force encourage industry to accomplish more of this work. The Air Force will have full time liaison personnel working directly with the Industrial Association Committees in the piece/part standardization program. Air Force liaison personnel will encourage accelerated development of Industrial Association specifications and standards; assist in identifying Air Force requirements and facilitate employment of Industrial Association specifications and standards in new system acquisition. Both industry and government will be capitalizing on the fact that in this particular instance their individual goals are similar. It is advantageous monetarily to both prime contractors and to the Government to minimize the number of new items entering the inventory. Under DoD Instruction 4120.8, authority is granted for the Air Force to employ industry prepared specifications and standards. Standards developed by industry groups composed of representatives of both manufacturers and users lend themselves to more universal application to various weapon systems than those prepared by prime or associate contractors. Industry groups are actively and vitally interested in a program of industry standardization. While we in Systems Command recognize that 100% of the piece/parts will not be controlled by this fashion, the high use parts, normally the 5900 and 5300 Functional Supply Group (FSG) classes which provide the greatest strain on our inventory, will be covered.

In addition to the large number of people addressing the problem of developing industrial association documents, most of the major prime contractors in the United States have substantial numbers of people specifically responsible for the standardization function within their company. The optimum time to prepare specifications and standards is when the components and parts are being developed for a weapon system. Many new components and parts designed for a specific system will have potential use on other current or future systems. Inasmuch as the development of items below the subsystems level are the responsibility of the contractor, he invariably prepares company type specifications. However, he could just as easily prepare military or industry type specifications and standards which would then have potential use on other systems. As a matter of actual fact, the specification format contained in AFSCM 375-1 invoked on all major contracts is even more inclusive than the 'MIL SPEC' format. Contracts will specify, when applicable, that contractor's development effort for components and parts be documented by an Air Force specification and/or standard. By providing close continuous liaison with the industrial associations as well as standardization personnel or prime contractors, both the Air Force and industry can profit significantly.

<u>Three steps</u> - Let's summarize what has been said so far. Step one of a three pronged attack upon the perennial problem of controlling the proliferation of new items entering the inventory is to make available the information to design agencies of what we have in our inventory from systems through components by the DDC Library function. Information on piece/parts will be provided by accelerated use of industrial association standardization groups as well as the utilization of cata-

loging services. Next will be the optimization of the employment by design agencies for that which is available in our inventory during the: Conceptual Phase; the Definition Phase, by including the RFP direction to the contractor that source selection will consider Government Furnished Equipment (GFE) vs Contractor Furnished Equipment (CFE) of subsystems and components; and in the Acquisition Phase, by development of Incentive Clauses to minimize the number of new items required for each component of CFE. And, most importantly, there is being formed an organization to assume the responsibility for the implementation and operation of this plan.

Slide - Documentation

This paper has treated almost exclusively the Command approach to the standardization problem. Before concluding, it is important that I touch ever so briefly upon the relation of this plan to the entire DoD effort. Addressing the problem of supporting documentation - at the very highest level, the DoD Directive 4120.3 clearly emphasizes the impact upon standardization made by research and development in engineering design. The Air Force implementation of this directive is contained in Air Force Regulation 73.1 This has just recently been published. A joint Systems Command and Logistics Command supplement to this regulation is currently being staffed. Additionally, a joint Standardization Manual is being prepared and coordinated.

Slide - Organization

Notwithstanding an outstanding plan, good intentions, and an abundance of documentation, the success of any program is primarily dependent upon people. The organizational structure and the manning for a program is paramount to its accomplishment. Control of the standardization effort in the Department of Defense rests with the Office of Technical Data and Standardization Policy. The Headquarters USAF counterpart is the Standardization Group in the Procurement Policy Division of the DCS for Installations and Logistics. At Systems Command Headquarters, the Office of Standardization is in the DCS/Systems. The Divisions will have a small, but highly qualified technical staff known as the Standardization Engineering Analysis Group (SEAG). The SPO's will have at least one man designated as the standardization technical representative. And, in addition, a group will be formed to perform technical liaison between the Air Force and Industrial Associations.

Slide - Bridge

At present, industry and government are unilaterally working the problem of standardization. For the most part, intra-company standardization activity is progressing at a commendable rate. Most prime contractors recognize that it is monetarily sound to minimize the administrative cost of developing hardware by optimizing piece/part selection for assembly into components and systems. For many years, government has been vitally concerned with the burgeoning supply inventory. It is costly in dollars and decreased operational effectiveness. In all too many instances, industry and government are attempting to bridge the problem of item control by starting from opposite shores and with no agreed upon plan for meeting. As a minimum, the point and conditions of contact must be clearly defined.

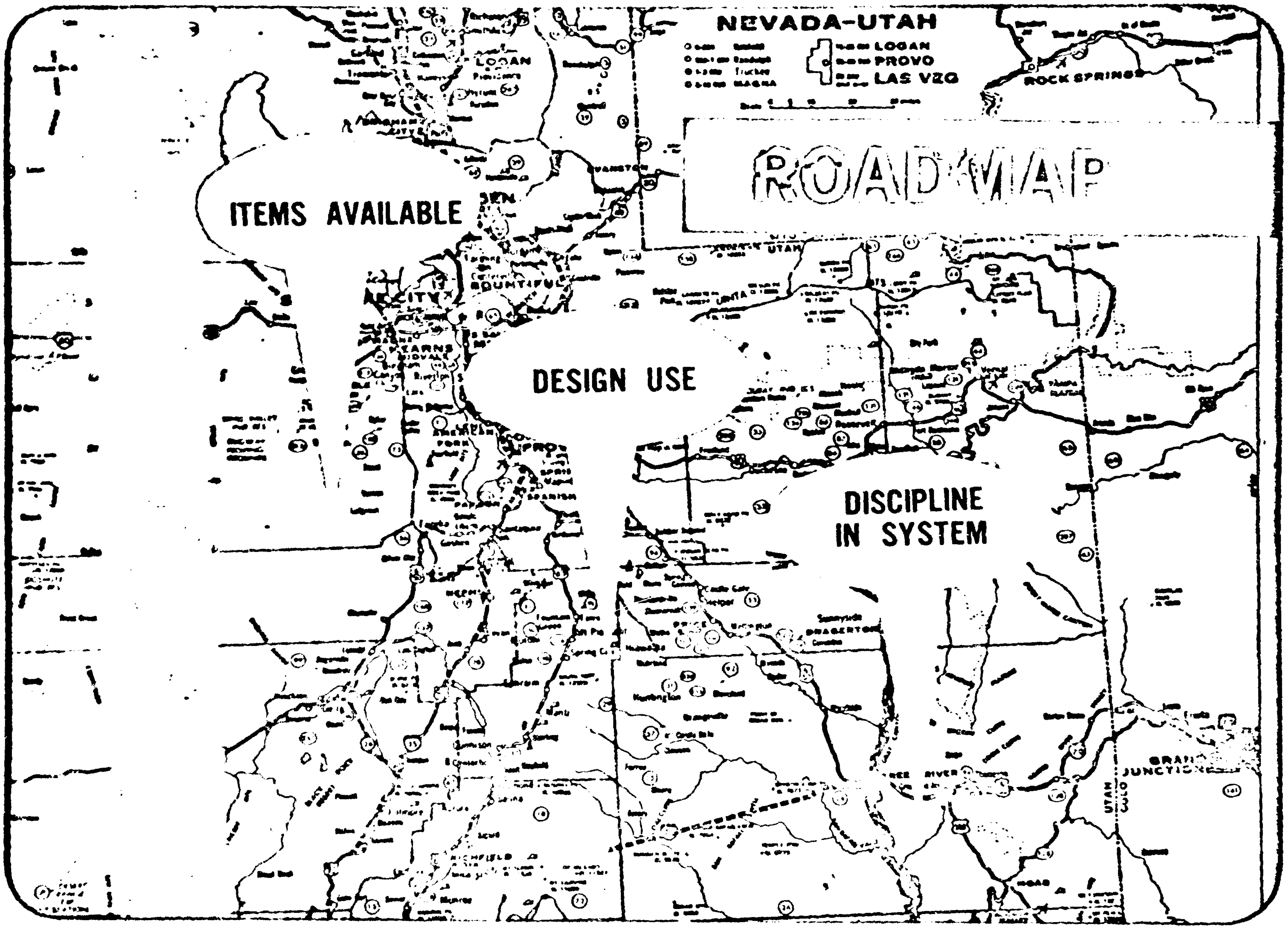
Systems Management - Systems Command, aided by Logistics Command is launching a headlong attack on this problem caused by increasing our inventory resulting in a decrease in our capability to maintain and supply our sophisticated weapon systems. Within the Systems Management concept, we can and will control the proliferation of new items and at the same time free the design engineer to expend truly creative effort. Our advancements in technology will not be at the sacrifice of systems availability, but will enhance our defense posture. It is hoped that the Air Force and Industry will join hands in this venture as they have on all of the other projects of national significance. By combining our efforts, we can and will achieve goals which are to the best interest of industry and to our nation.

STANDARDIZATION F-111 A AVIONICS

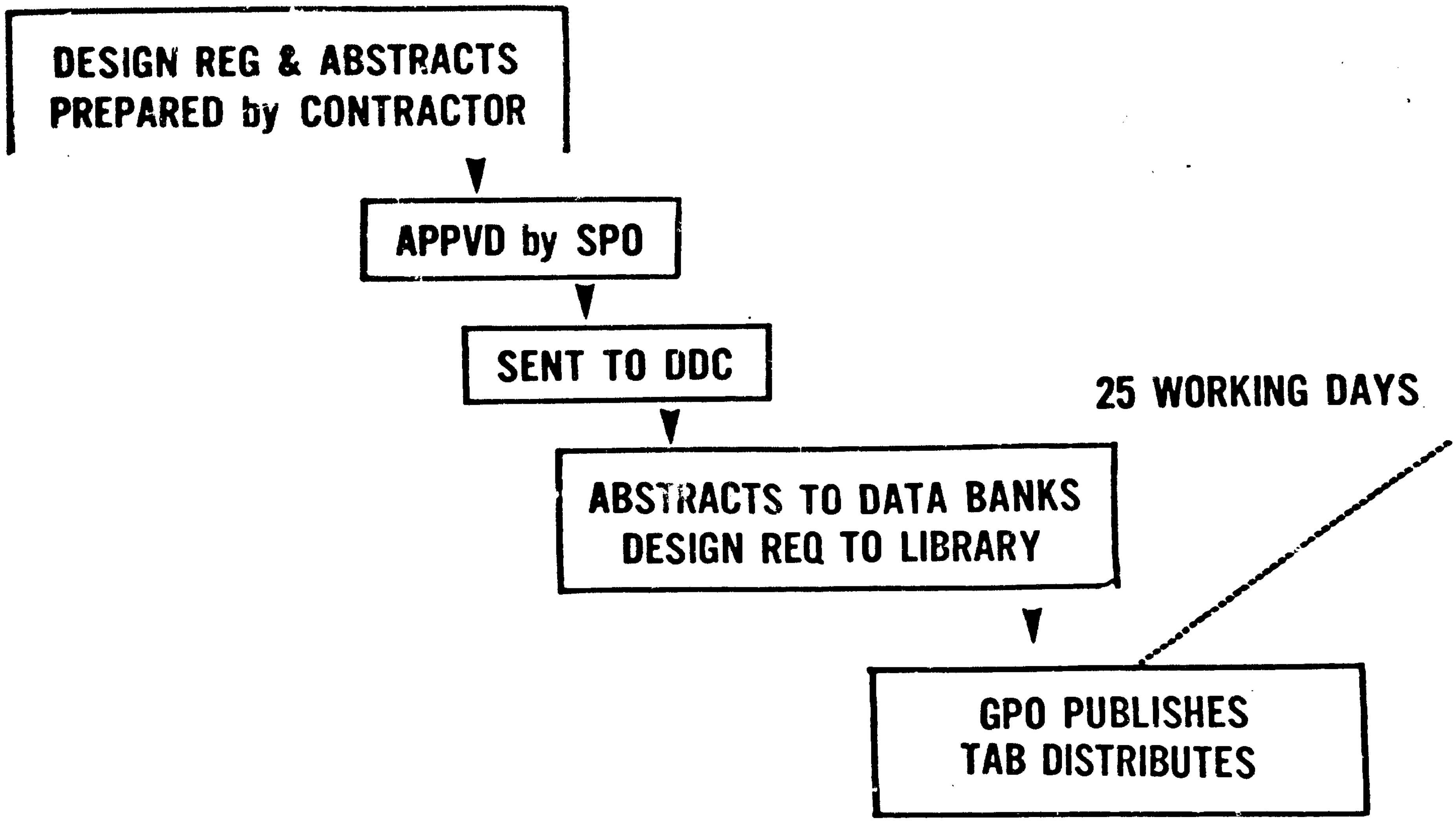
	POPULATION PER AIRCRAFT	PART TYPES or STYLES	STANDARDIZATION RESULTS	
			NUMBER OF TYPES	% OF TOTAL POPULATION
TRANSISTORS	7,500	77	20	92
DIODES, RECT., SCR	10,900	90	20	91
RESISTORS	27,000	72	4	92
CAPACITORS	10,200	111	11	85

STANDARDIZATION F-111 ELECTRONIC AGE

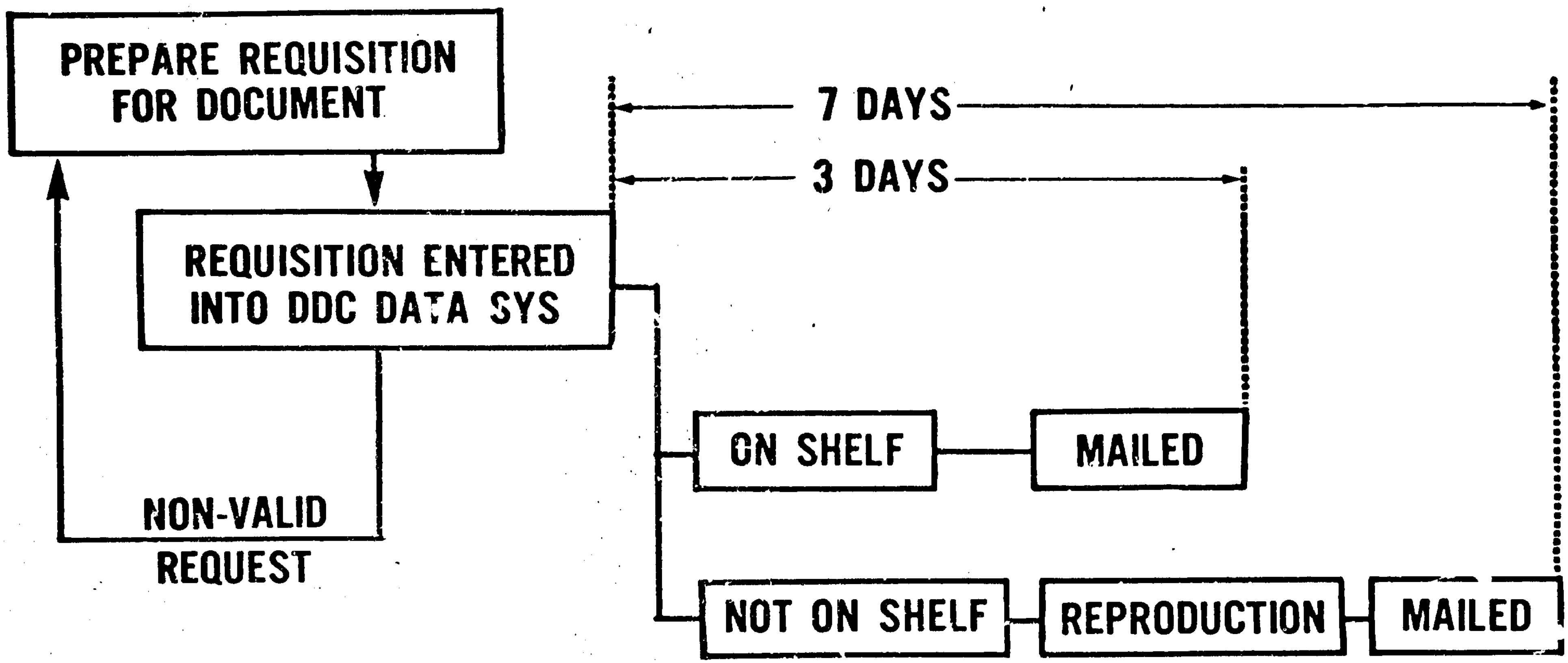
	POPULATION PER A&E SHOP	PART TYPES OR STYLES	STANDARDIZATION RESULTS	
			NUMBER OF TYPES	% OF TOTAL POPULATION
TRANSISTORS	21,000	19	4	98
DIODES, RECT., SCR	56,800	25	4	99
RESISTORS	58,100	17	1	98
CAPACITORS	14,000	14	4	98


ROADMAP
ITEMS AVAILABLE
DESIGN USE
DISCIPLINE IN SYSTEM
NEVADA-UTAH
LOGAN
PROVO
LAS VEG
ROCK SPRINGS
BOUNTIFUL
GRAND JUNCTION

PROCESSING NEW 375-1 DATA



DDC DOCUMENT PROCESSING



DOCUMENTATION

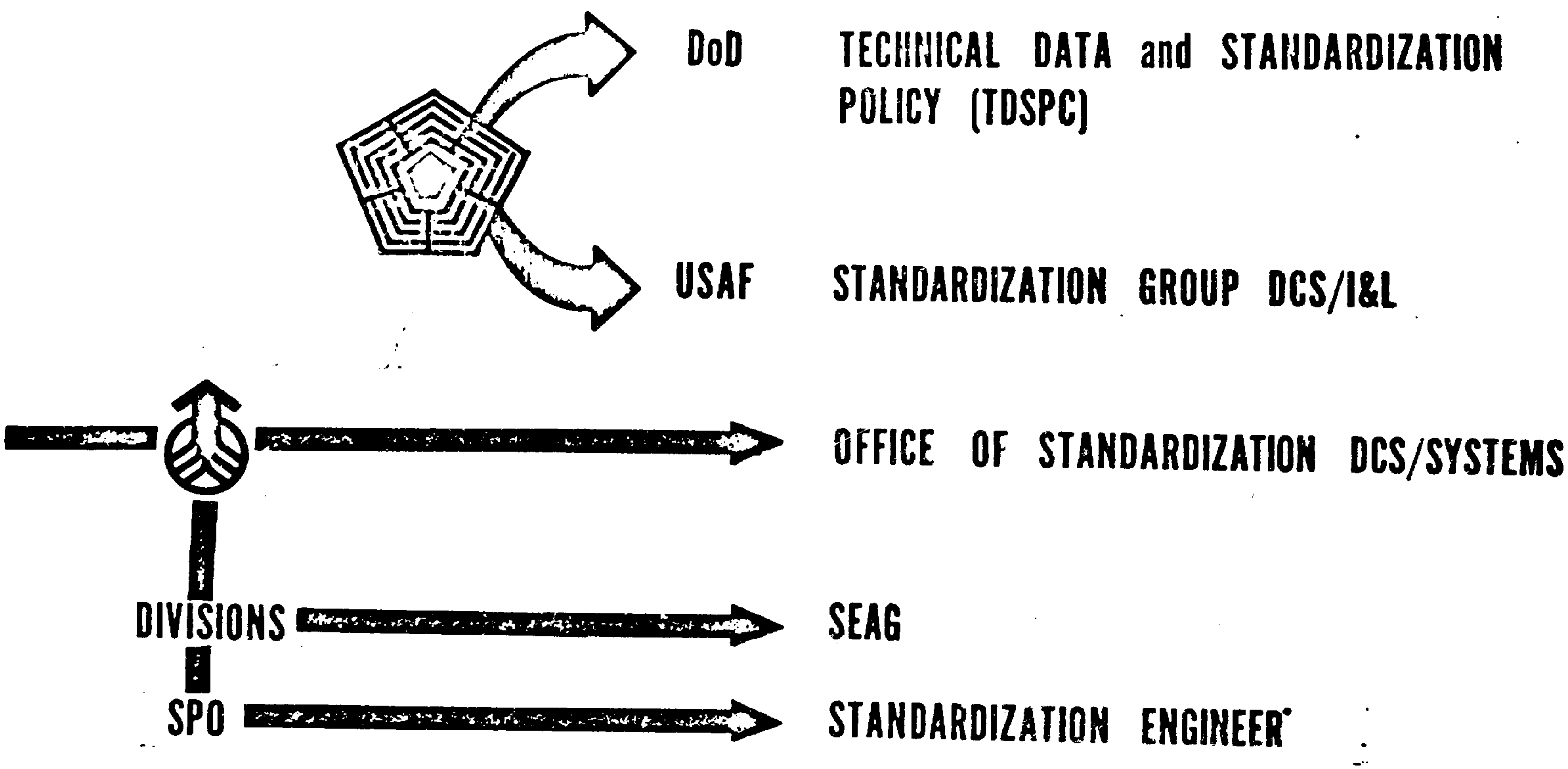
PUBLISHED

DOD DIRECTIVE 4120.3
AFR 73-1

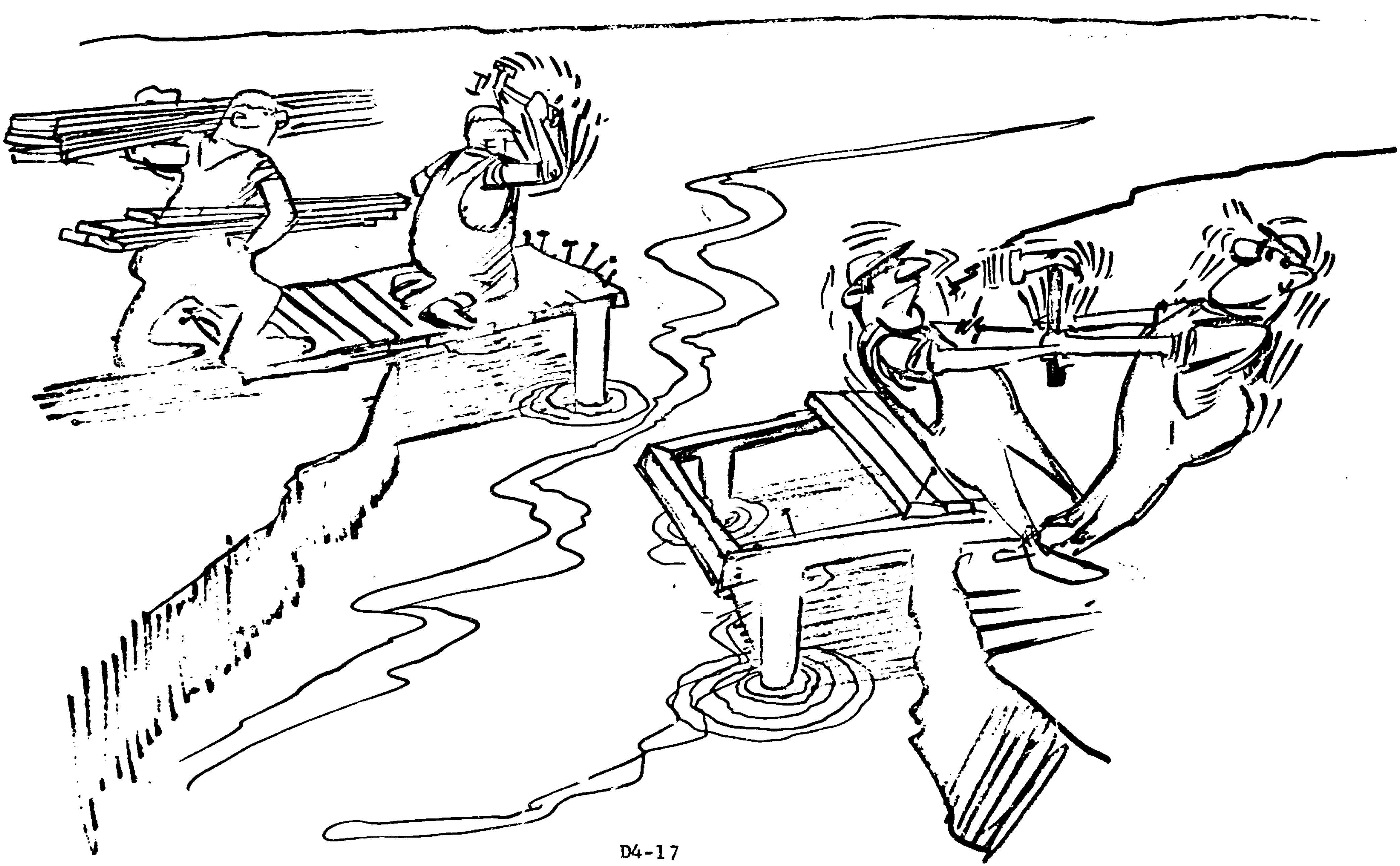
IMMINENT

AFSCR AFLCR 73-X
AFSCM AFLCM 73-2
AFSCM 70-X

MANAGEMENT STRUCTURE



AIR FORCE LIAISON - INDUSTRY ASSOCIATION



D4-17

DATA MANAGEMENT & THE CONTRACTOR'S ORGANIZATION

Mr. Donald R. Spencer
Chief, Engineering Data Requirements
McDonnell Aircraft Corporation

Slide #1

Much has been said about data management in the course of the last two years, just as much is being said about it here today. Most discussion has been in terms that are very broad, and not much has been said about the fundamental elements effecting data management which interface with the functional organization we find in most prime contractors' plants today.

Slide #2

I feel that this generality and its resulting lack of distinction between data and documentation is a contributing factor to confusion in implementing data management today. And so I would like to take data as it has been defined by the government, to break this definition into its elements, and to interface them with typical contractor organization and examine the results. It is hoped that, by doing so, insight can be gained into the effect of data management on the prime contractor's organization and that positive understanding will develop which will, in turn, be useful in implementing data management, that will better serve the contractor and achieve the real objectives of the government.

My talk today is predicated on a fundamental difference between the functions of data management in the military and in the contractor's organization. The Department of Defense defines data management in DOD-INST 5010.12 as, and I quote:

Slide #3

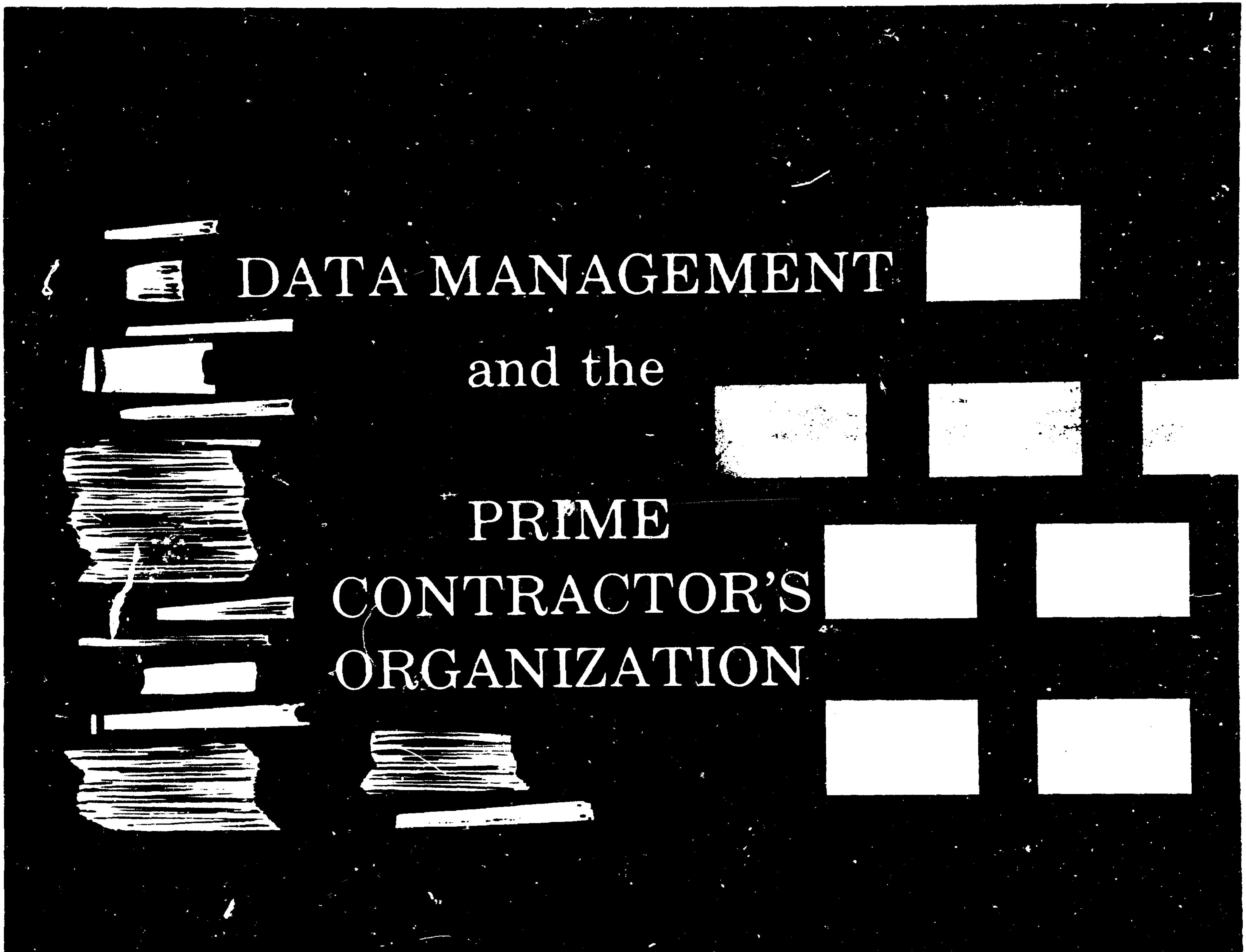
"The function of determining and validating data requirements planning for the timely and economical acquisition of data and insuring the adequacy of acquired data for its intended use."

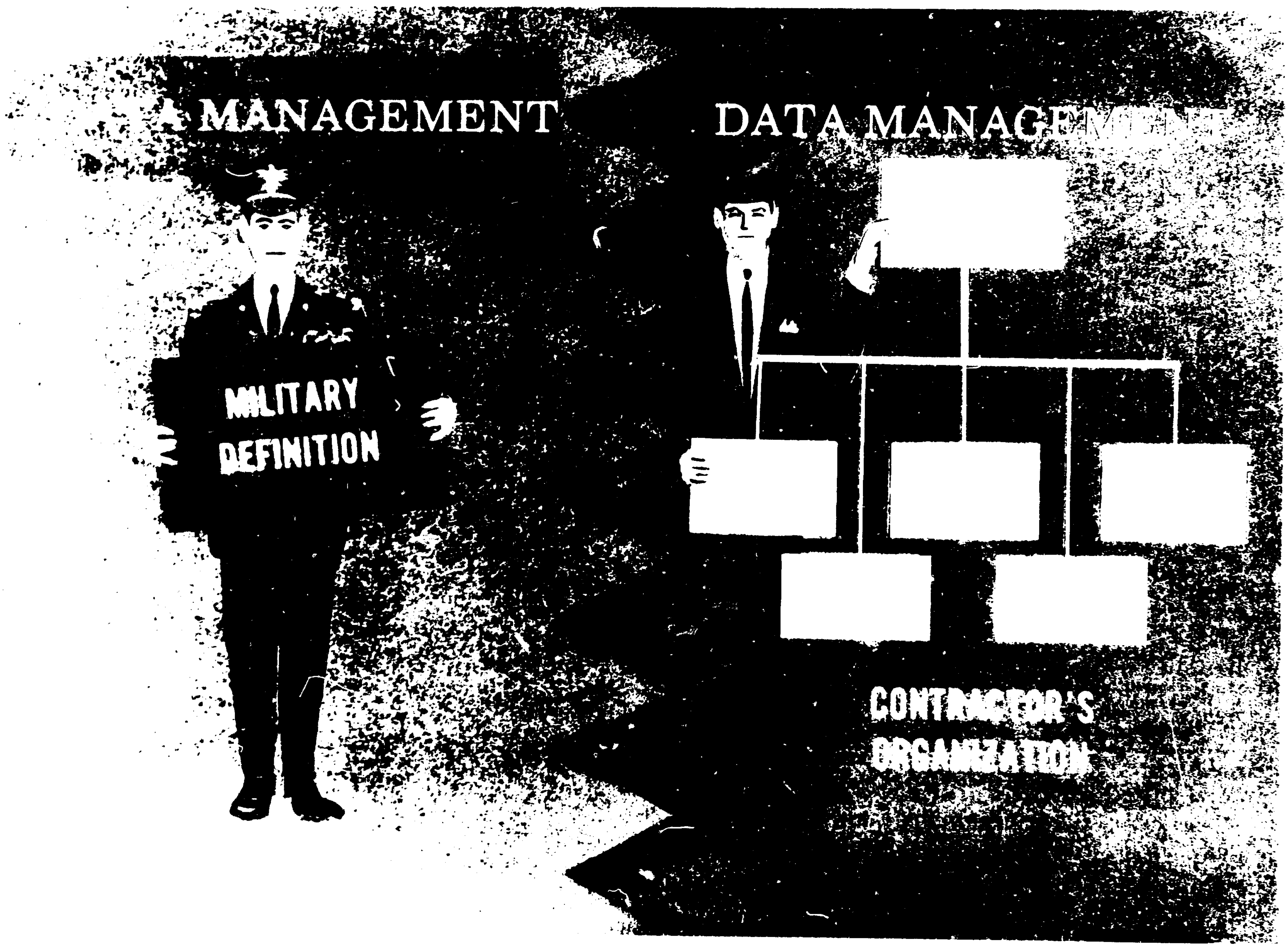
Slide #4

This task in the military is essentially a program management job concerned with acquisition of adequate data on a timely basis. The government manuals describe a systematic approach to the identification of requirements, evaluation of these requirements and the implementation of them contractually so as to start a contractor on the path to the generation and recording of data. The contractor continues from this point. He must recognize the objectives of the data manager in the military, but he must go further.

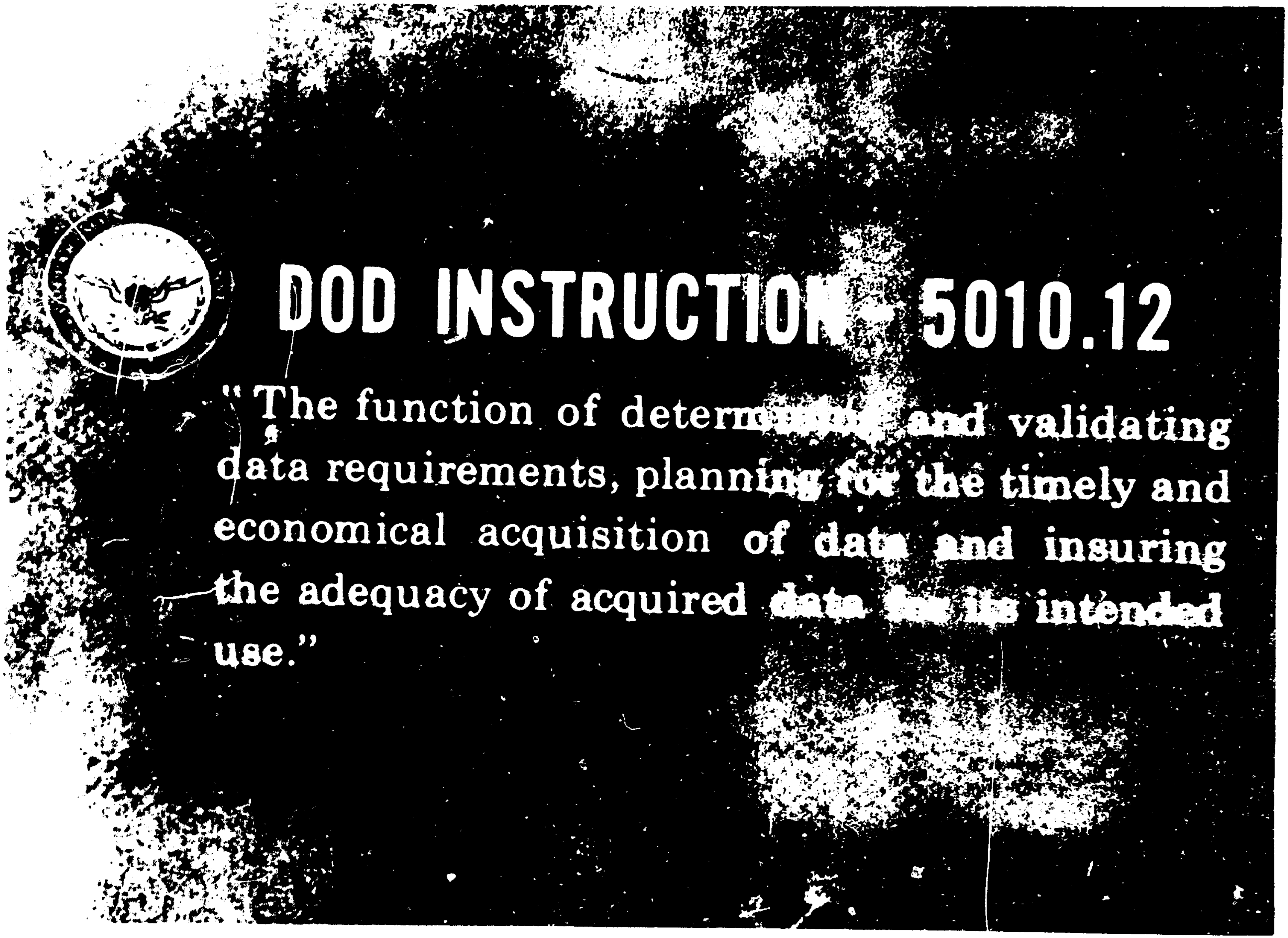
Slide #5

He must influence his organization so as to cause it to deliver the documents which are required. And this generation results in an essential difference between data management as it is practiced in industry and data management as it is being practiced in the military.


DATA MANAGEMENT
and the
PRIME
CONTRACTOR'S
ORGANIZATION

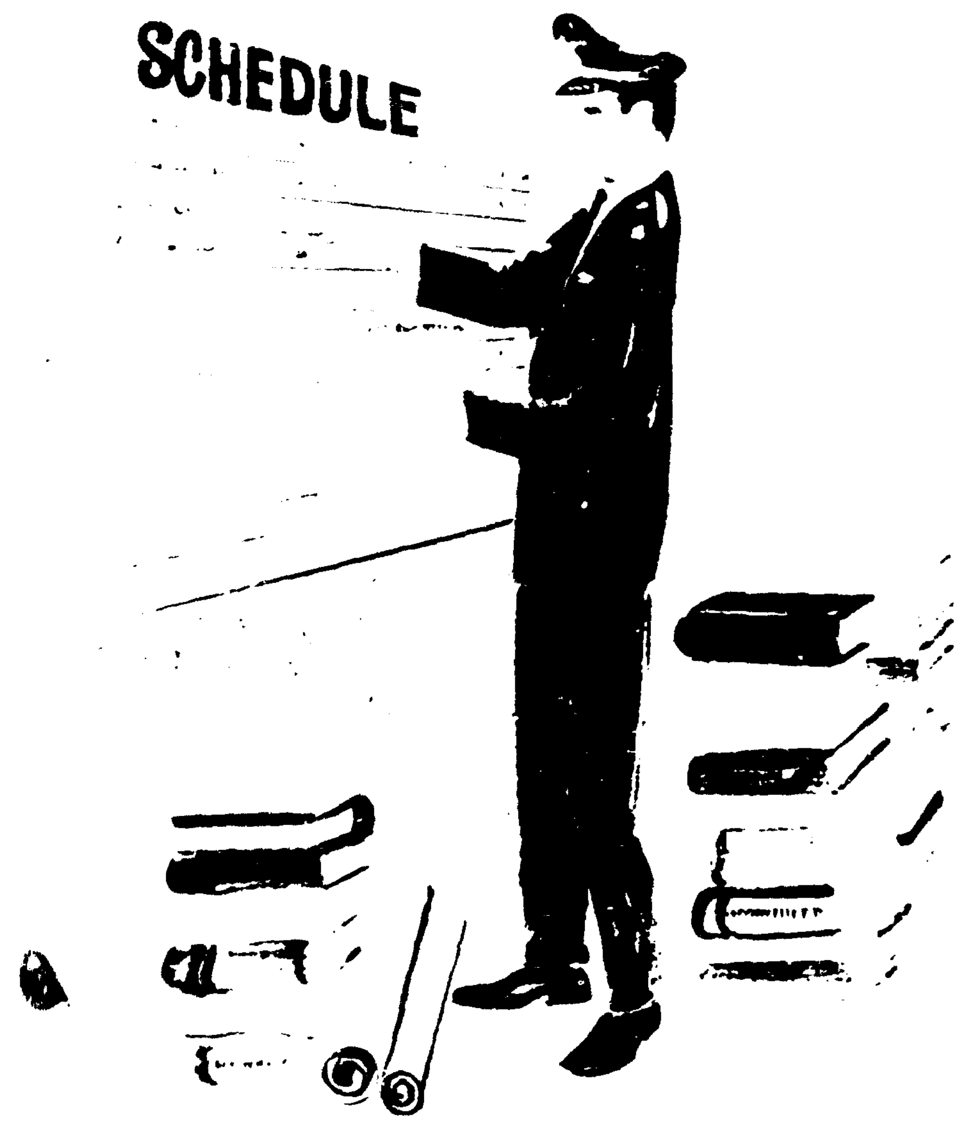


Slide #2

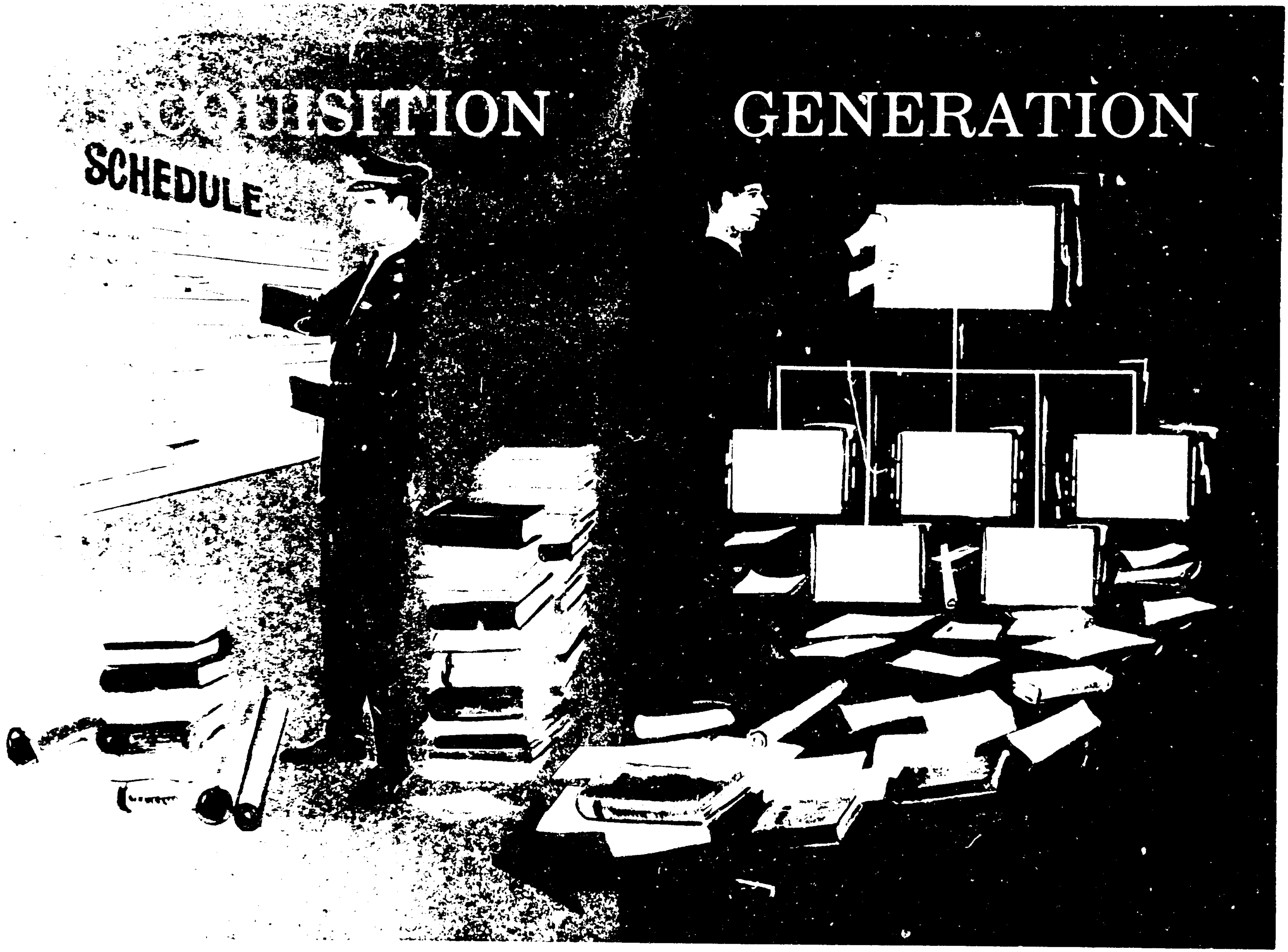

DOD INSTRUCTION 5010.12
"The function of determining and validating
data requirements, planning for the timely and
economical acquisition of data and insuring
the adequacy of acquired data for its intended
use."

D5-4

Slide #3



Slide #4



Slide #5

I think that data management in the contractor's organization is:

<u>Slide #6</u>

The process of developing response by members of the organization having <u>functional responsibility</u> so as to insure identification of valid data requirements and timely and economical availability of data which is adequate for use by the contractor and his customer.

This definition provides the same objectives as the definition of data management given in DOD Instruction 5010.12 and reiterated in subsequent manuals issued by the government, but is oriented to the generation of data. There is more difference in my definition of data because, as I said a few minutes ago, I believe there is need to separate data from documentation and to define each.

This thought requires a different <u>definition</u> of data and this also is significant to my discussion today. Let's continue by discussing data as described by the government. And here, again, I'm going to get fundamental and quote from some of the basic government publications. The Department of Defense describes data in DOD Instruction 5010.12 as follows:

<u>Slide #7</u>

<u>Technical Data and Information</u> - The means for communication of concepts, plans, descriptions, requirements, and instructions relating to technical projects, materiel, systems, and services. <u>These may include</u> specifications, standards, engineering drawings, associated lists, manuals, and reports, including scientific and technical reports; they may be in the form of documents, displays, sound recordings, punched cards. . . .

This form of description has been modified to some extent, but largely passed on unchanged in the various manuals issued by the different agencies of the government to describe data management. Let's cite one and recognize that, with minor variation, these citations apply generally. Air Force Manual 310-1 defines data in volume I, and I quote:

<u>Slide #8</u>

"Data - The general term data includes, without limitation, all engineering and logistics source <u>information and documentation</u> derived during the conception, definition, acquisition, and operational support phases of a complete system equipment or item. These contractor data, whether or not copyrighted, include:

(1) Administrative Reports
(2) Technical Reports
(3) Other Data. . . . ."

I have this observation to make regarding these definitions:

<u>Slide #9</u>

While they acknowledge a difference - few of the government's documents precisely distinguish between "data" and "documentation" in effect. The reverse is true - they are considered to be synononmous. As I have said, <u>I believe that this failure to distinguish is a major factor associated with confusion in implementing data management in industry and the government. And I will tell you why in just a moment</u>.

The process of developing a response by members of the organization having FUNCTIONAL RESPONSIBILITY so as to insure identification of valid data requirements and timely and economical availability of data which is adequate for its intended use by the contractor and his customer.

Slide #6

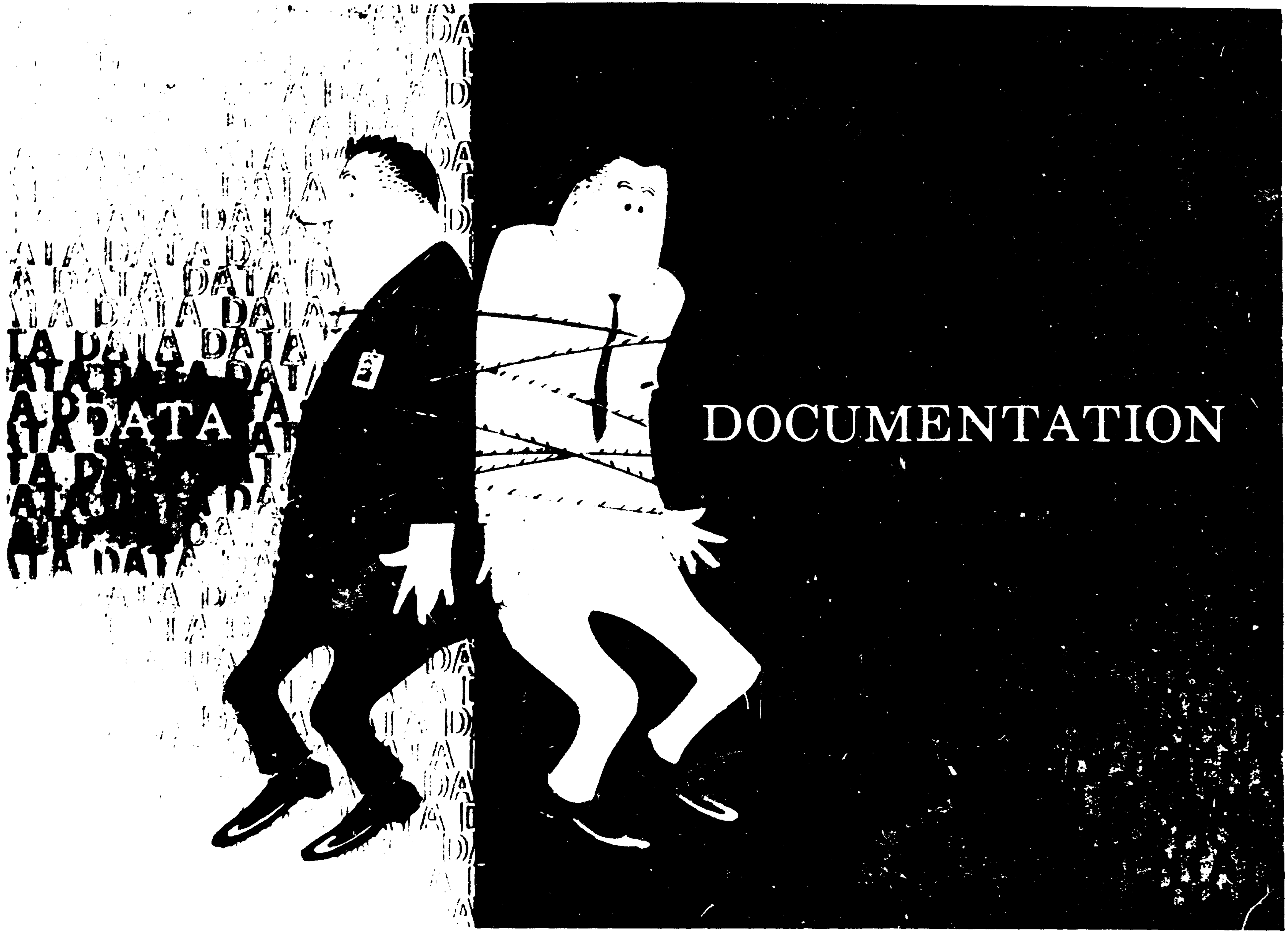
DEPARTMENT OF DEFENSE

"TECHNICAL DATA AND INFORMATION - The means for communication of concepts, plans, descriptions, requirements, and instructions relating to technical projects, material, systems, and services. THESE MAY INCLUDE specifications, standards, engineering drawings, associated lists, manuals, and reports, including scientific and technical reports; they may be in the form of documents, displays, sound recordings, punched cards. . ."

Slide #7

AIR FORCE MANUALS

"Data - The general term data includes, without limitation, all engineering and logistics source INFORMATION AND DOCUMENTATION derived during the conception, definition, acquisition, and operational support phases of a complete system equipment or item. These contractor da whether or not copyrighted include: (1) Administrative repo (2) Technical reports. . . (3) Other data. . ."



Slide #9

First I would like to give you what I regard as essential definitions of data and documentation. Again, I have turned to basic reference documents for these definitions - in this case Webster. Webster defines data as:

Slide #10

. . . . "Factual material used as a basis especially for discussion or decision."

He defines documentation as:

. . . . "The act or an instance of furnishing or authenticating with fact; the assembling, coding, and disseminating of recorded knowledge treated as an integral procedure."

The relationship is obvious.

Slide #11 -

Data is information or knowledge developed by other action which when recorded becomes documentation; documents are hard copy end products. Each is mutually interdependent, but each is subject to separate management of a distinctive nature within the contractor's organization. Generation of data is the responsibility of technical talent - engineers - while documentation management is an ancillary service entailing administration of such things as recording, coordination of format, publication, scheduling, submission,s and other general requirements.

Slide #12

The government, by definition and treatment, equates one to the other without distinction and, for this reason, obscures the interface between the two.

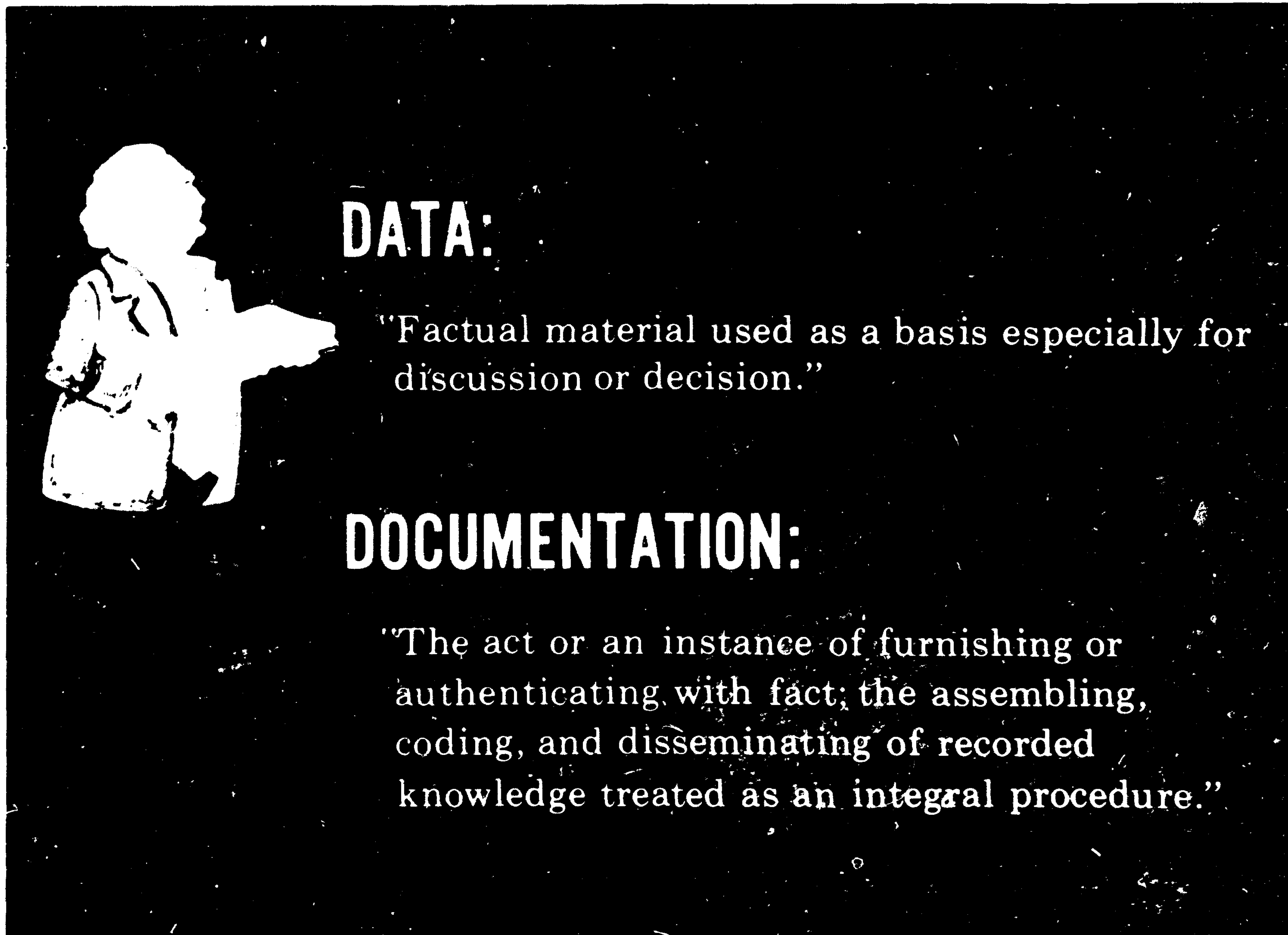
Slide #13

This is a third factor, for this interface is rightly an area of line management. The other two are in either service functions or line organizations. Failure to distinguish suggests making a data manager responsible for all and, in industry, results in redundant organization. This has happened where industry members have felt the obligation to establish counterpart organizations to the data management structure of their customer(s) and where they have used the customer's manuals as a guide for this organization. Licensing data managers in industry as the government has described the job is a bit like making a locomotive engineer responsible for driving the train, as well as for the configuration and contents of the train - when actually he is just supposed to couple the right cars and to get the train to its destination intact and on time.

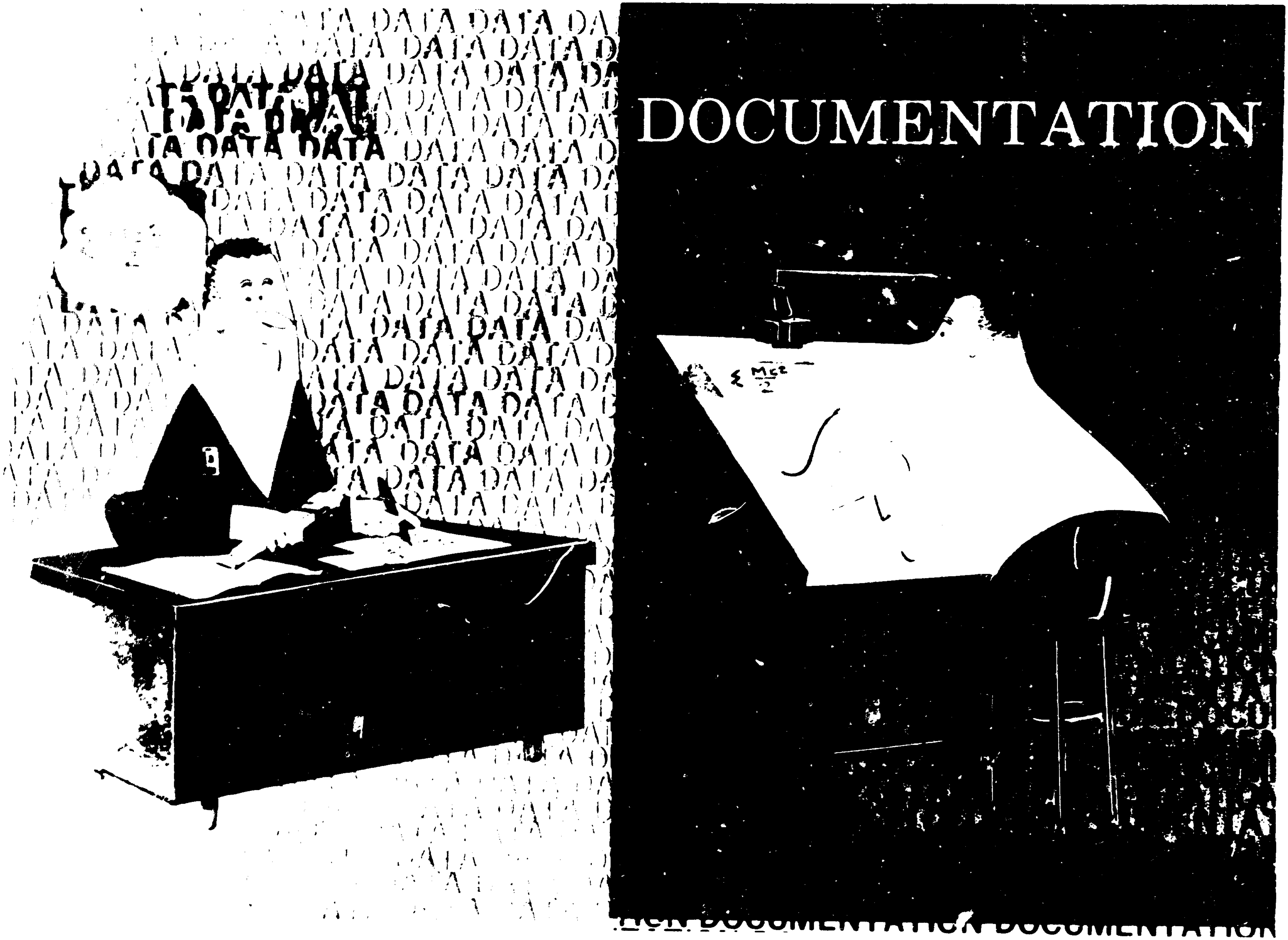
The foregoing statements will become more obvious if we look at the typical contractor's organization and at his contractual spectrum. Let's look at the contracts first because they pose an organization complication and this must be recognized.

Slide #14

You will see in this slide a representation of the total contractual complex of a major prime contractor as a cube with each dimension showing a variable in data requirements. In this case, the "X" axis represents customers; the "Z" axis represents

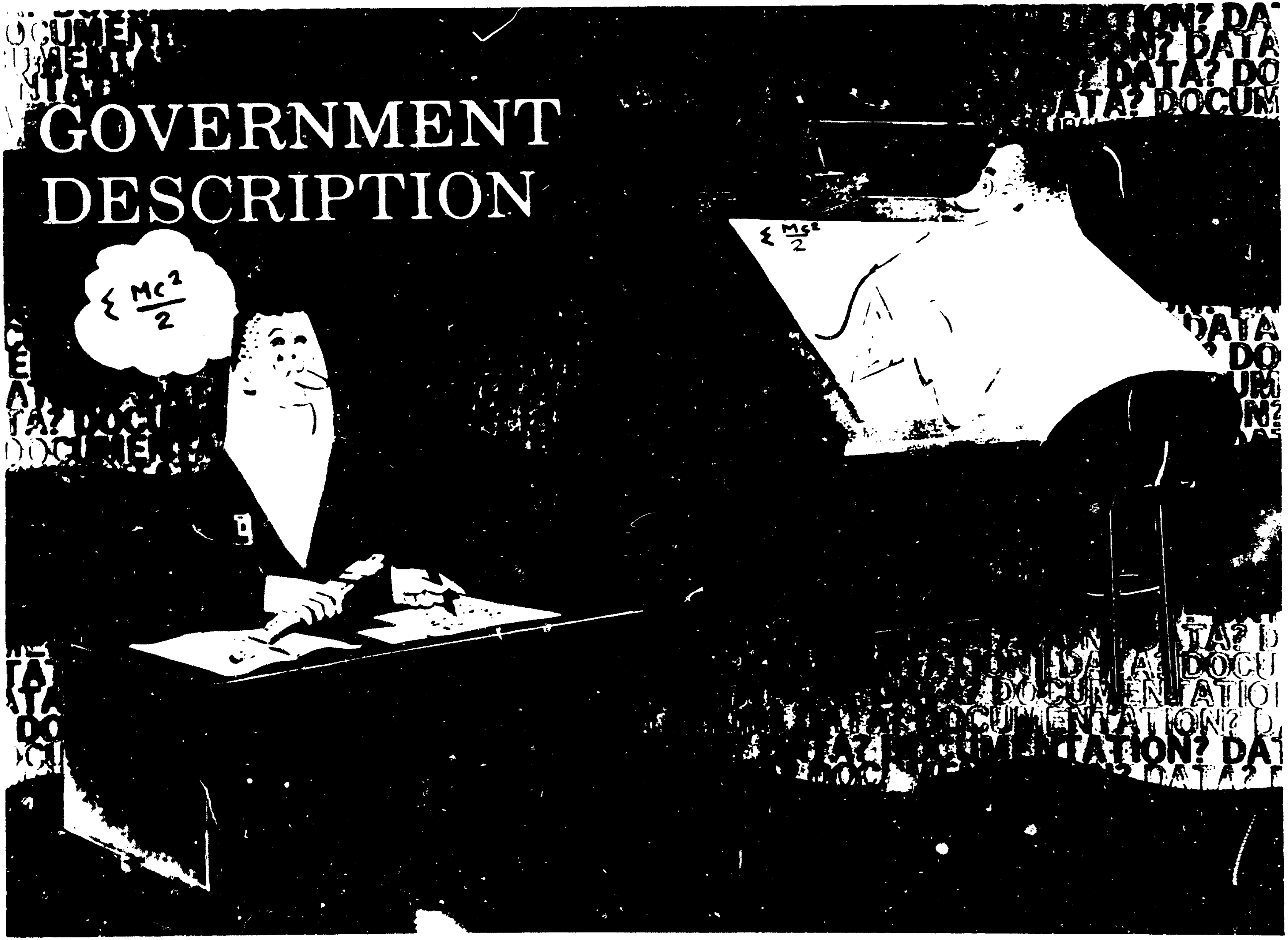

DATA:
"Factual material used as a basis especially for discussion or decision."
DOCUMENTATION:
"The act or an instance of furnishing or authenticating with fact; the assembling, coding, and disseminating of recorded knowledge treated as an integral procedure."

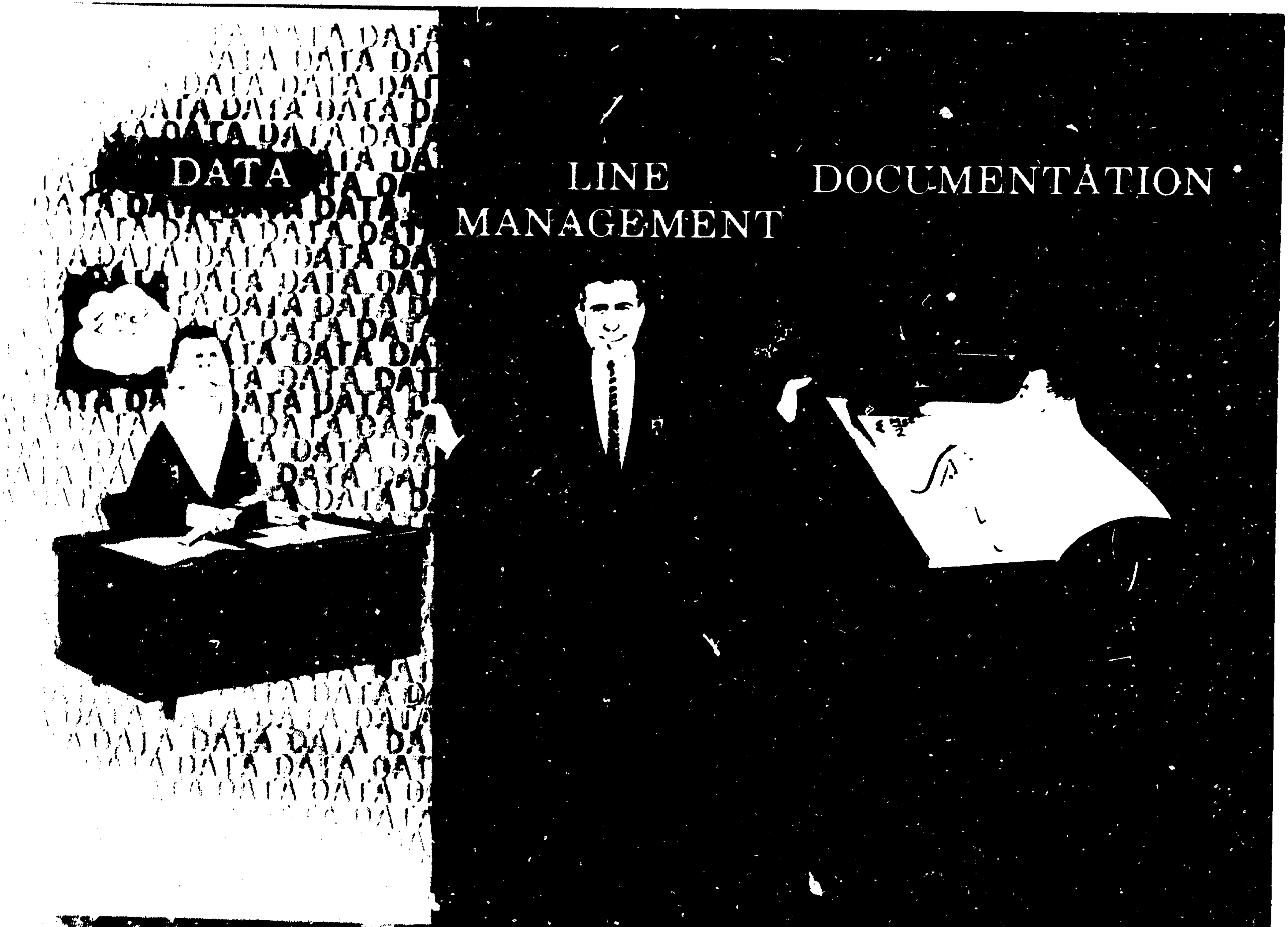
Slide #10



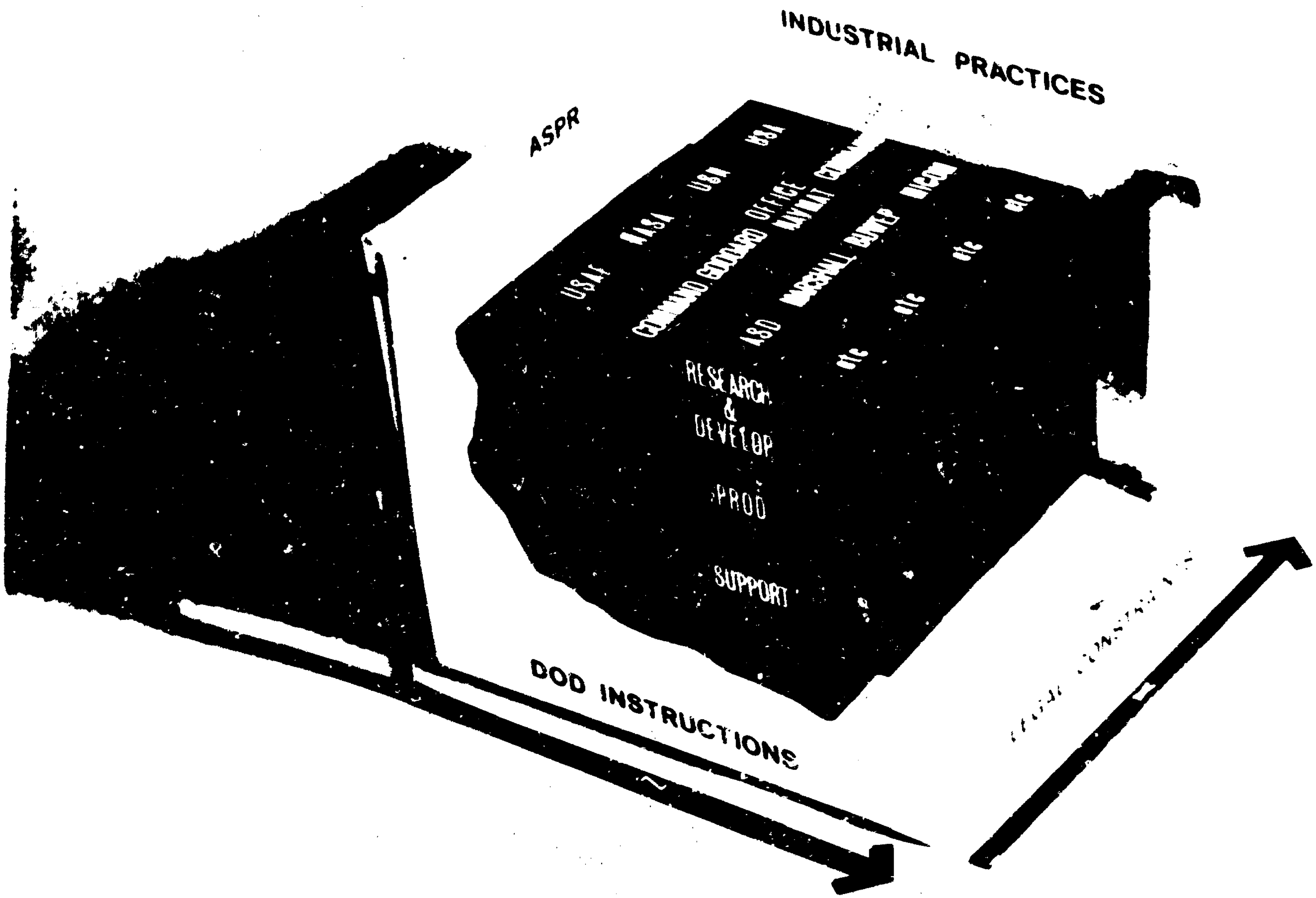
DS-14

Slide #11


GOVERNMENT
DESCRIPTION
$\Sigma \frac{Mc^2}{2}$
$\Sigma \frac{Mc^2}{2}$


DATA
LINE MANAGEMENT
DOCUMENTATION

Slide #13



Slide #14

the subdivision of the primary customer - for example, the aeronautical systems division within the Air Force. The "Y" axis represents the variation of the data product from contract to contract for a given customer. The whole complex is then enclosed by general regulation - the armed services procurement regulations, industrial practice, legal constraints, and so forth as shown by the outer box. This model shows the data requirements of each contract as a block within the whole complex. Each is similar to the other, but each also has a separate identity with a separate set of requirements. These vary in some degree according to program and customer requirements. The outside box or constraints have standardization and control as their goal, but the real controller is the contractor. He must understand and communicate all of these varying contractual requirements to his organization. He must integrate them and control as unilaterally as possible so as to cause the whole complex to become an aggregate of efficient operation within the company across its total spectrum of business. And this, gentlemen, is one of the real challenges of data management to the company organization today. This challenge is not diminished by the divided approach by the agencies of the government in regard to management of data and documentation.

Let's now look at the contractor organization. Most companies are broken into operating elements supported by staff functions. This arrangement can be illustrated by a general block diagram.

Slide #15

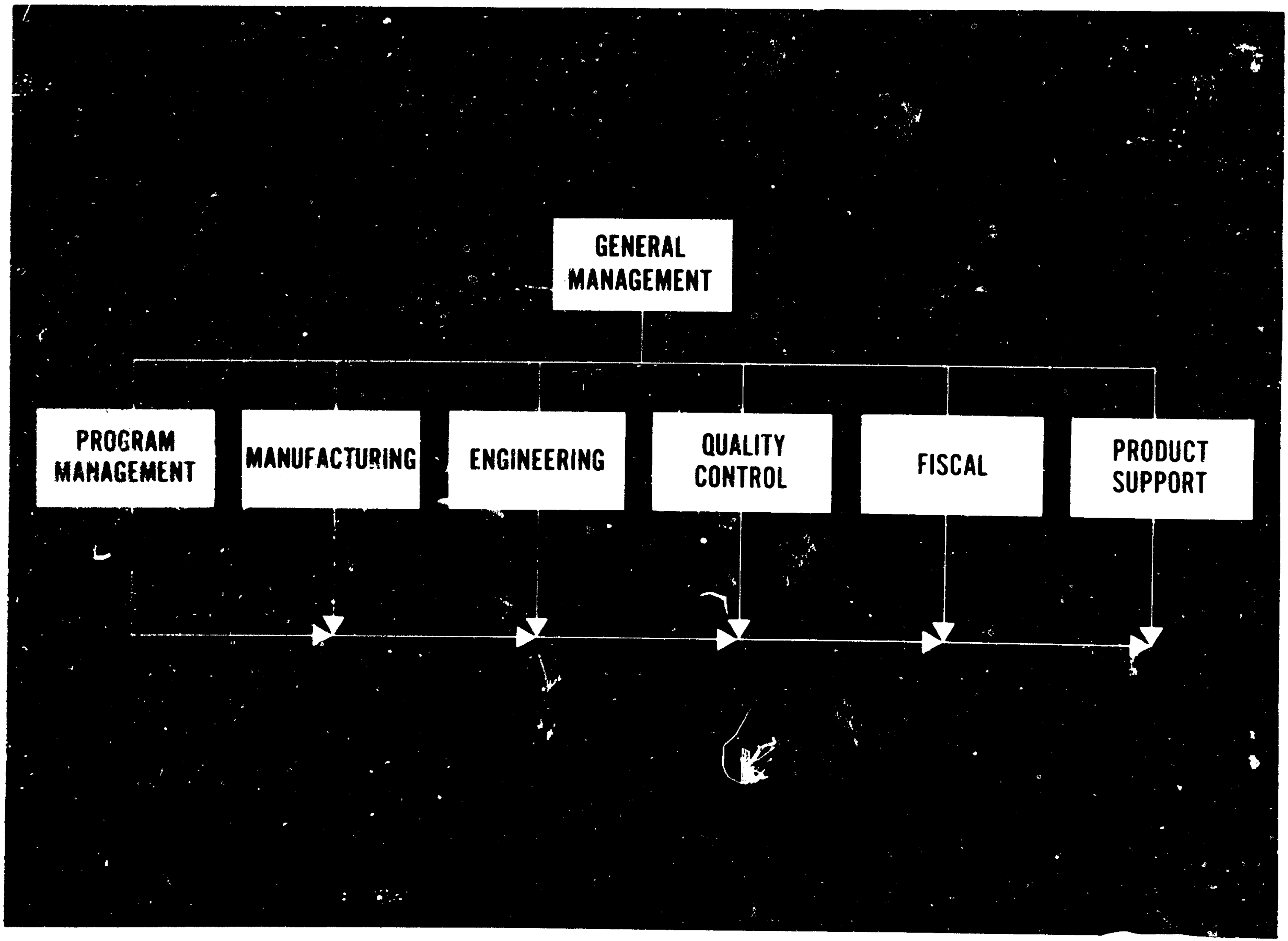
This arrangement is true at the broadest level whether the company is centralized or divisionalized along product lines. The figure shows the essential elements in the organization as manufacturing, quality control, engineering, product support, fiscal, and so forth. Top management is assisted in most contractor's organizations by management staff groups called program or project management. These are shown on the left side of the slide and result in a matrix type organization as shown. Projectizing within this structure is the usual case with support from common service organizations.

Slide #16

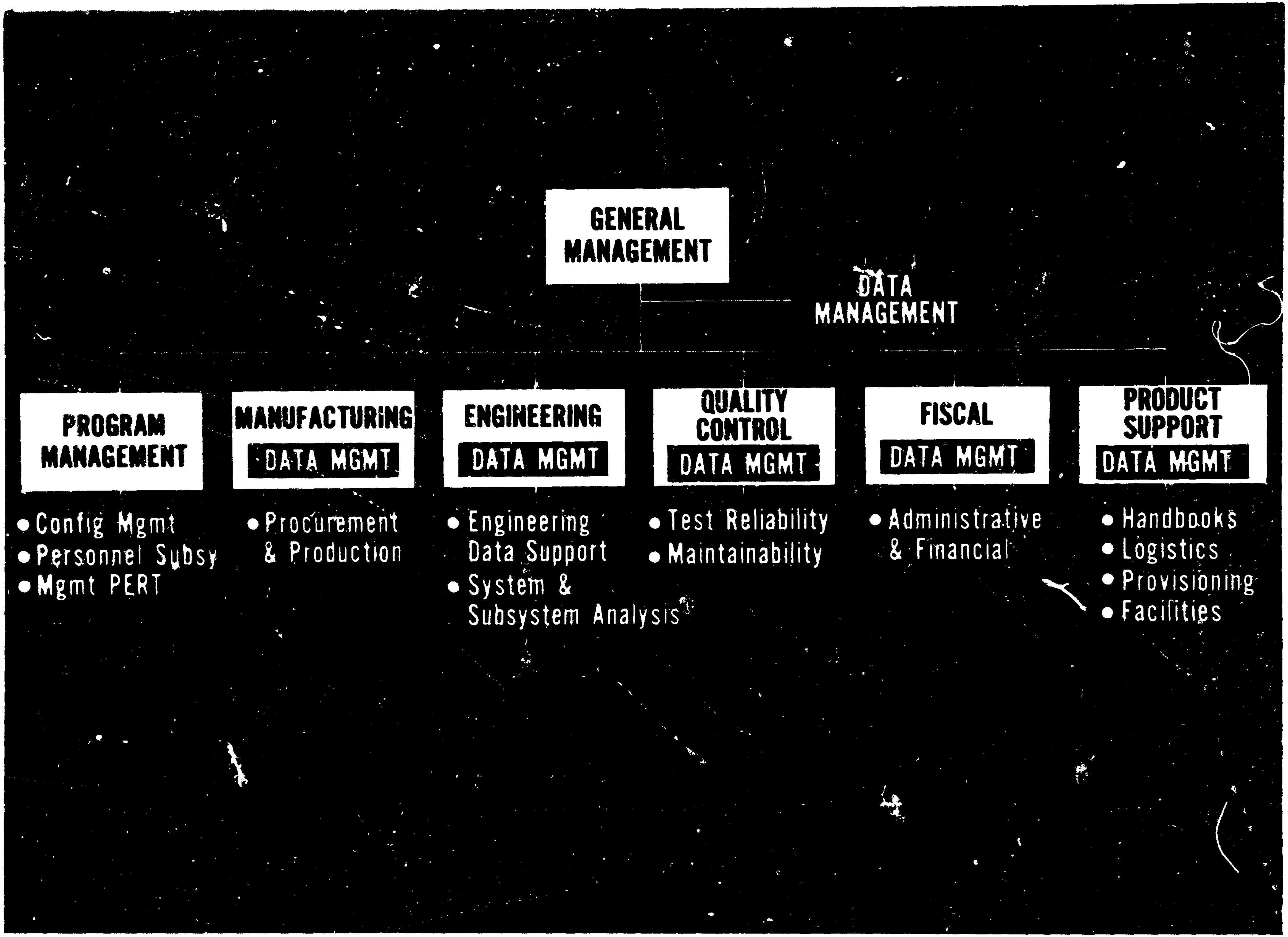
Now in this next slide, the categories of data from USAF manual 310-1 have been broken out for purposes of illustration and arbitrarily assigned to organization on the basis of primary responsibility for creation of the documents making up the category. Many of you might assign these differently. It is also recognized that there is mutual interdependence between many of the data items, and many of the line departments within the organization in relation to the documentation. But in general this allocation is valid. Categories from 310-1 were used because they are considered typical. And they do show how data relates to organization. Mutual interdependence of documents and basic management practices establishes need for an agency to cross organizational lines at the general management level. Responsibility for preparation of certain categories of data and documents requires administration within the line organization where those documents are prepared. And so two areas of data management interest in the contractor's organization are thus shown - one having general management interests, the second having divisional interests of parochial nature.

Slide #17

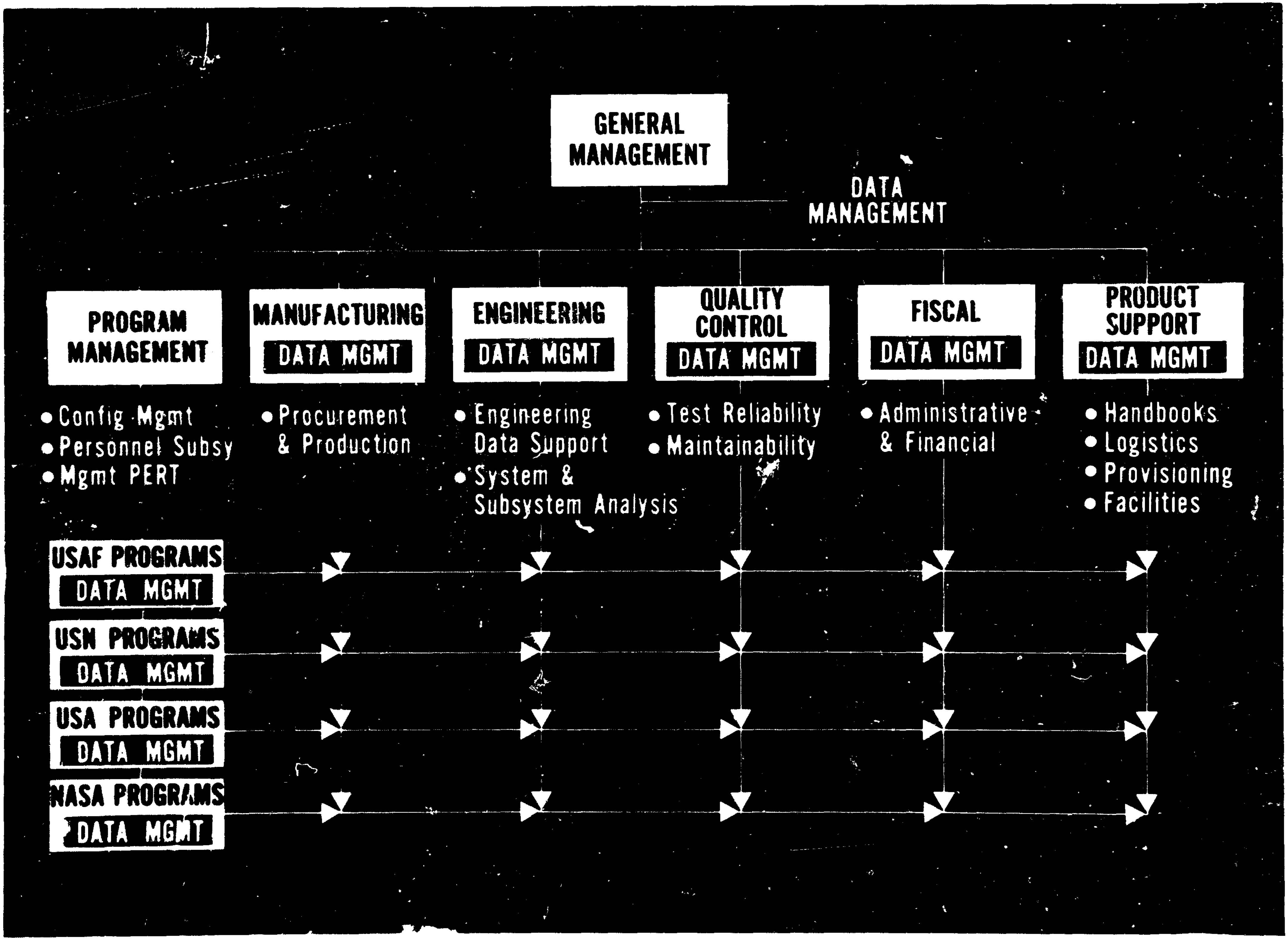
This next slide adds the various customer interfaces to the organization. These are added to the program management side of the organization and there are four assuming that there are contracts from each of the agencies promulgating data management. This, of course, introduces four systems of data management and adds to the


GENERAL MANAGEMENT
PROGRAM MANAGEMENT
MANUFACTURING
ENGINEERING
QUALITY CONTROL
FISCAL
PRODUCT SUPPORT

Slide #15


GENERAL MANAGEMENT
DATA MANAGEMENT
PROGRAM MANAGEMENT
MANUFACTURING
DATA MGMT
ENGINEERING
DATA MGMT
QUALITY CONTROL
DATA MGMT
FISCAL
DATA MGMT
PRODUCT SUPPORT
DATA MGMT
• Config Mgmt
• Personnel Subsy
• Mgmt PERT
• Procurement & Production
• Engineering Data Support
• System & Subsystem Analysis
• Test Reliability
• Maintainability
• Administrative & Financial
• Handbooks
• Logistics
• Provisioning
• Facilities

Slide #16


GENERAL MANAGEMENT
DATA MANAGEMENT
PROGRAM MANAGEMENT
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PRODUCT SUPPORT DATA MGMT
• Config Mgmt
• Personnel Subsy
• Mgmt PERT
• Procurement & Production
• Engineering Data Support
• System & Subsystem Analysis
• Test Reliability
• Maintainability
• Administrative & Financial
• Handbooks
• Logistics
• Provisioning
• Facilities
USAF PROGRAMS DATA MGMT
USN PROGRAMS DATA MGMT
USA PROGRAMS DATA MGMT
NASA PROGRAMS DATA MGMT

Slide #17 & 28

case for a data management interest at the program level, thus adding a third area of data management interest within the organization - one which most closely resembles the customer's data management office. Later, I will examine each of these and the interfaces and working relations among them.

With this understanding of the contract picture and basic organization, I would like to again return to the statement which I made earlier in regard to the definitions of "Data" and "Data Management" as given in the various government instructions and manuals.

Slide #18

This statement, in essence, was that I believe that failure to precisely distinguish between "Data" and "Documentation" is a major contributing factor to the confusion associated with implementation of data management today. When organizational interests are recognized, the need to distinguish between data and documentation and pay attention to the interface is recognized as essential to establishing effective data management in a contractor's organization.

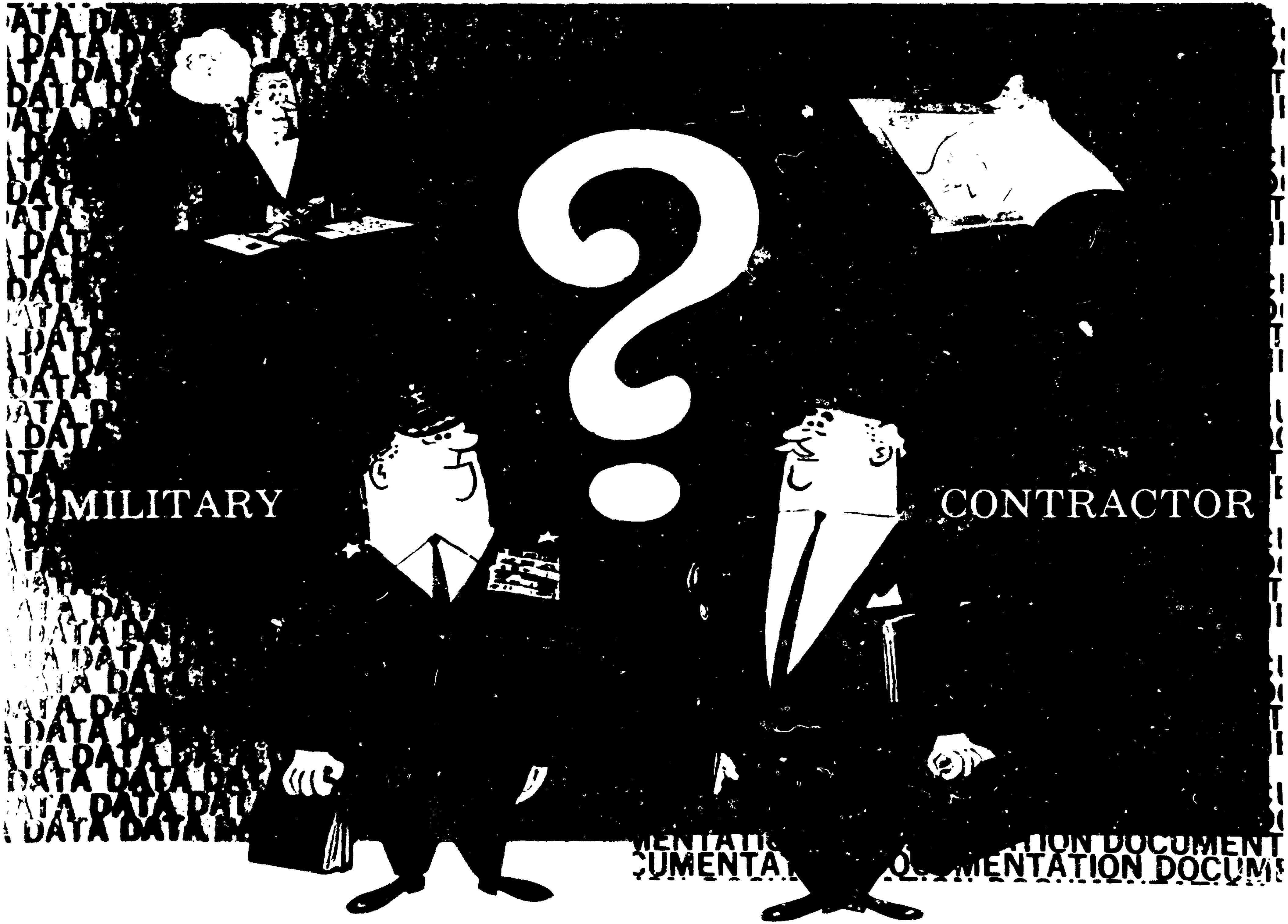
Slide #19

It enables assignment of data management elements to appropriate organizational channels. That is - essentials for deriving information to the technical talents, essentials relating to documentation administration to procedural functions and essentials relating to interfaces to management. It preserves the assignment of authority with responsibility; it eases description of personal qualifications; and it enables easier correlation of data management to other current management disciplines being promulgated by the government - some of which are more easily assigned organizationally. And, of course, it also eases the specific definition of the data management job which we shall look at shortly. But these are not the only reasons for distinguishing between data and documentation.

There are other more basic reasons to distinguish. Data does not lend itself to generalization. It is developed in a given place for a specific purpose and applied to given circumstance, while documentation has broader organizational implications. For example - an engineering drawing may be used by a dozen different departments, but the data contained thereon remains specific and is specifically applied in each different case. The characteristics of the document (format, if you will) must accommodate the generator and recorder of the data and all others who use it. The engineer developing the design should not also have to concern himself with title block layout, the release procedures, numbering system, monitoring of submission, etc. Someone who understands documentation management should do this and does so in most companies.

Slide #20

Let's look at the human factors for a moment. Documentation management is not necessarily in consonance with the basic interests of the technician. A man remains an engineer because he is primarily interested in creating. He could hardly be a successful engineer if he were not an innovator. Compliance with format or other general documentary requirements is not innovation. And so we have a basic conflict situation between the engineer who wants to design and develop and does not necessarily want to be restricted to the format requirements of a contract, a customer, or anyone else and the data manager who has been trained in the school of data acquisition requirements of the government and who is in there trying to convince the engineer that he should observe these requirements in order to satisfy the contract.



Slide #18

ORGANIZATIONAL REQUIREMENTS

Assignment to Appropriate Channels

Preservation of Authority With Responsibility

Description of Personal Qualifications

Correlation to Other Management Disciplines

Definition of Data Management

D5-24

Slide #19

D5-25

Slide #20

It also seems to me that the emphasis is out of balance. All of the manuals dealing with data management describe data management as a systems management job. They show data with regard to the various logic functions required by the various phases of a development program. Systems management is necessary and the benefit which has been derived is certainly not to be minimized.

Slide #21

Such things as establishing data acquisition based on real need, the evaluation of cost associated with data, the time phasing of data, advancement in storage and retrieval of data are all products of the discipline implicit in application of "system management" to data by the government and the results are good, but gains in these areas are not enough.

It is equally as important that more guidance be given to the functional line organization which is charged with the responsibility for coming up with these data. Frankly, we've talked too much to the "system implication" of data management and not enough about the practical aspects of creating documents and content for documents. This is due in large measure to a fallacy. Most of the manuals on the subject presuppose that if you identify need for data, describe a document by something like a form 9, put the document name on a CDRL, schedule it, then follow up to see that it comes in on schedule, you'll get "data" and this data will do the job - this is a misconception. You will only get data if the generator in the line operation recognizes the need for the information, is capable of developing it, and records it in a form that the user can read, store and retrieve. And unless this happens, gentlemen, you have managed the heck out of a system and gotten documents maybe, but not data.

Slide #22

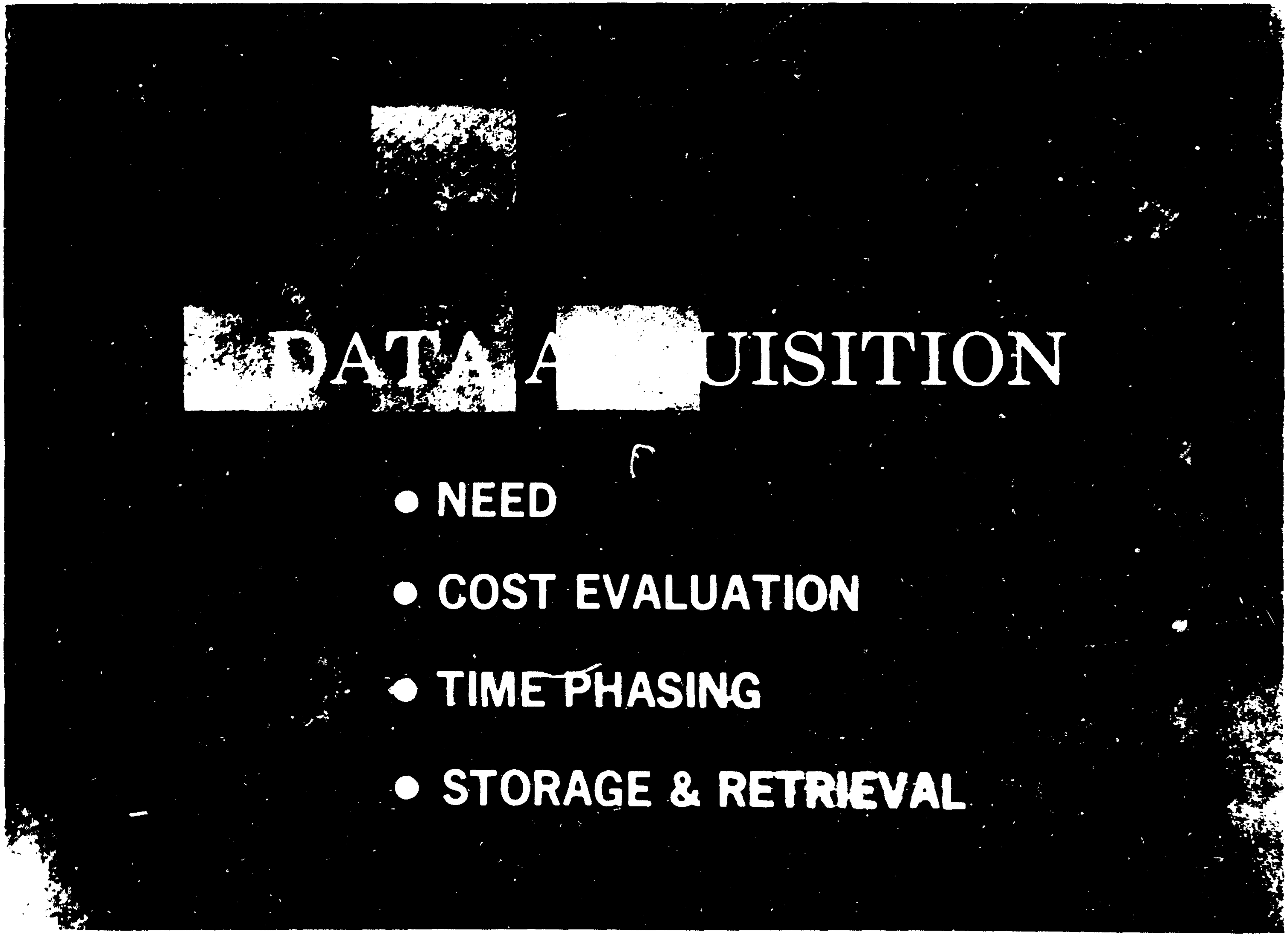
Let's pay attention to the line organization and recognize that these operations are the forges on which adequate, timely, and economical data are wrought - not the DMO office, nor the program office, nor anywhere else. It is the effort of the engineer who conceives an idea, puts pencil to paper, draws or writes fast, accurately, and legibly, and dashes off to give the copy to someone, that we have been trying to systemize. Let's look at how data management functions for just a moment - as we said before

Slide #23

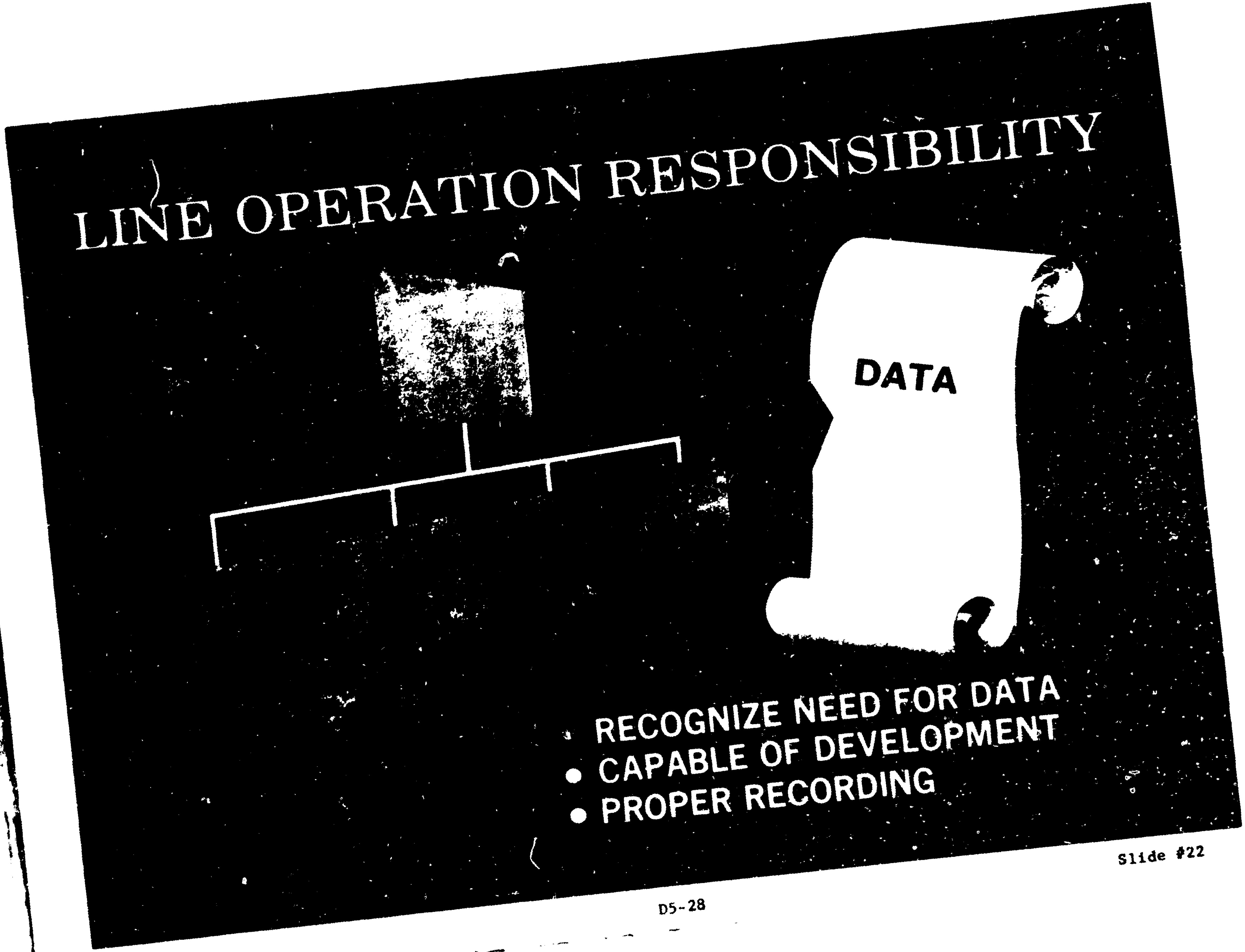
An engineer is an engineer because he likes to innovate, and conformance to format is just a factor to contend with. By nature he objects when such things are foisted off on him. And who does he object to -

Slide #24

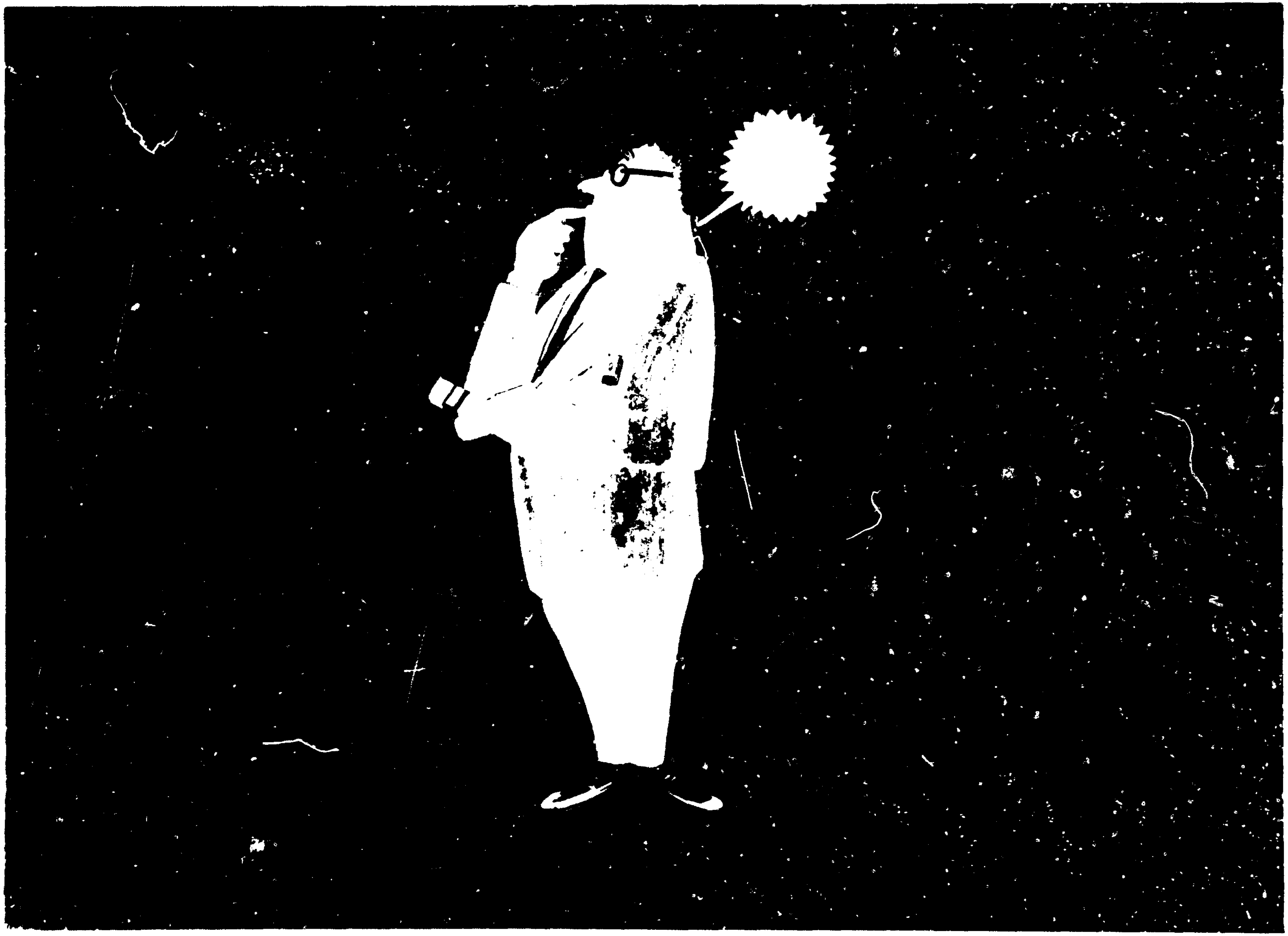
His boss who also is a design engineer and who has three other designers squawking to him because they too have each had a data system forced on them - remember four customers - all the boss wants to do is get some design done and to spend no more time in recording it than necessary. He sure as heck doesn't want to educate his people to four ways of documenting design. So he throws the data manager out of his office the first two times and the data manager finally comes back with his boss's boss who is also the design manager's boss and who more than likely is really sympathetic to the design manager, having come up through the design shop, but he says: "Look Joe----! and so the data manager and the design manager become friends and all sorts of adequate, timely, and economical data flows out of the design department and on to the customer who uses it forevermore---yep!


DATA A UISITION
• NEED
• COST EVALUATION
• TIME PHASING
• STORAGE & RETRIEVAL

Slide #21

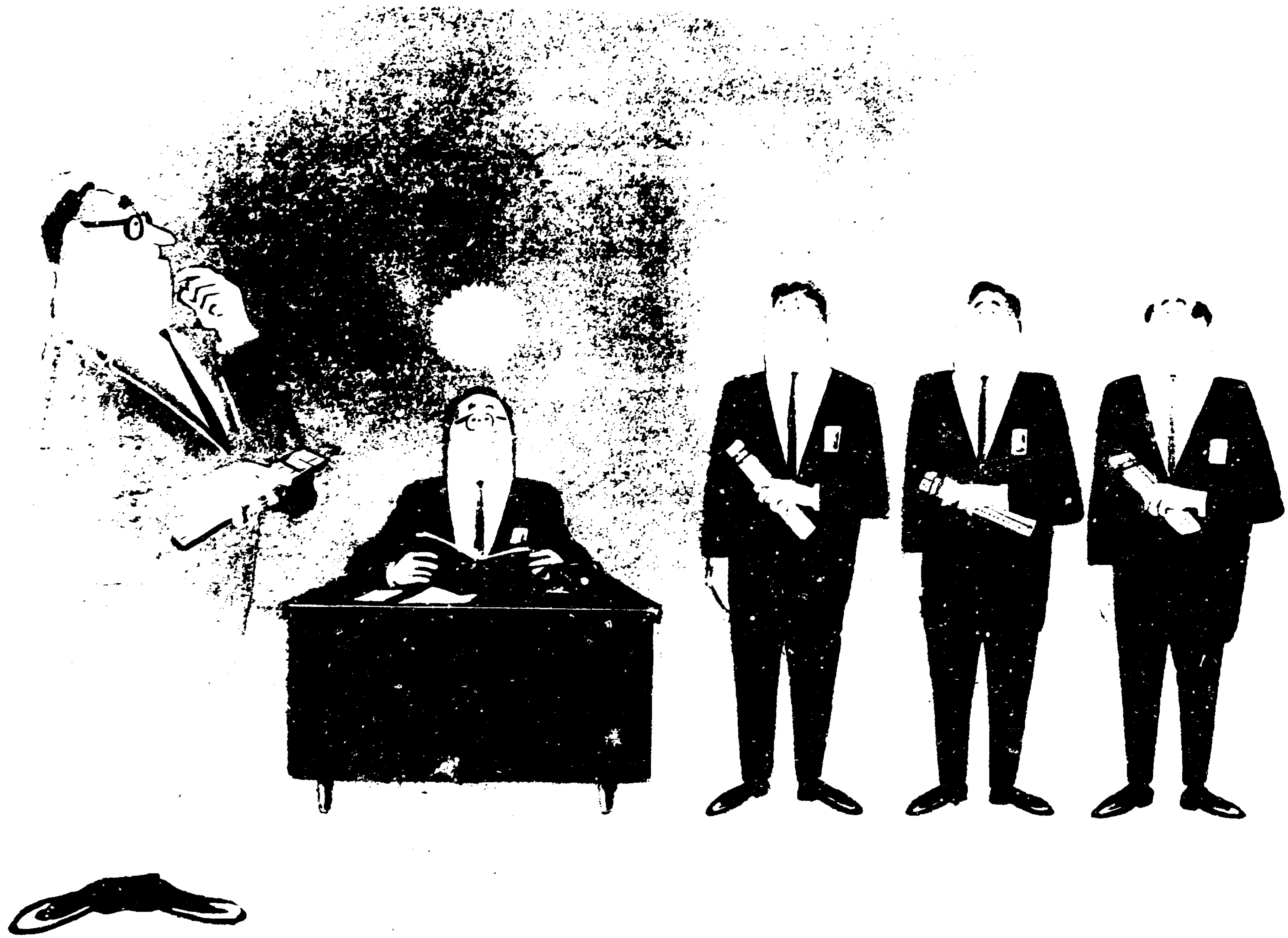

LINE OPERATION RESPONSIBILITY
DATA
RECOGNIZE NEED FOR DATA
CAPABLE OF DEVELOPMENT
PROPER RECORDING

Slide #22



D5-29

Slide #23



Slide #24

This certainly does not describe very smooth responsiveness to the customer's need for data, but it is fairly typical of the climate in which documentation management is being cultivated. And little is done to offset this by the contractor who addresses maximum effort to the systems management implication of data management and minimum effort to the problems of the working Joe who must create data and record it in documents.

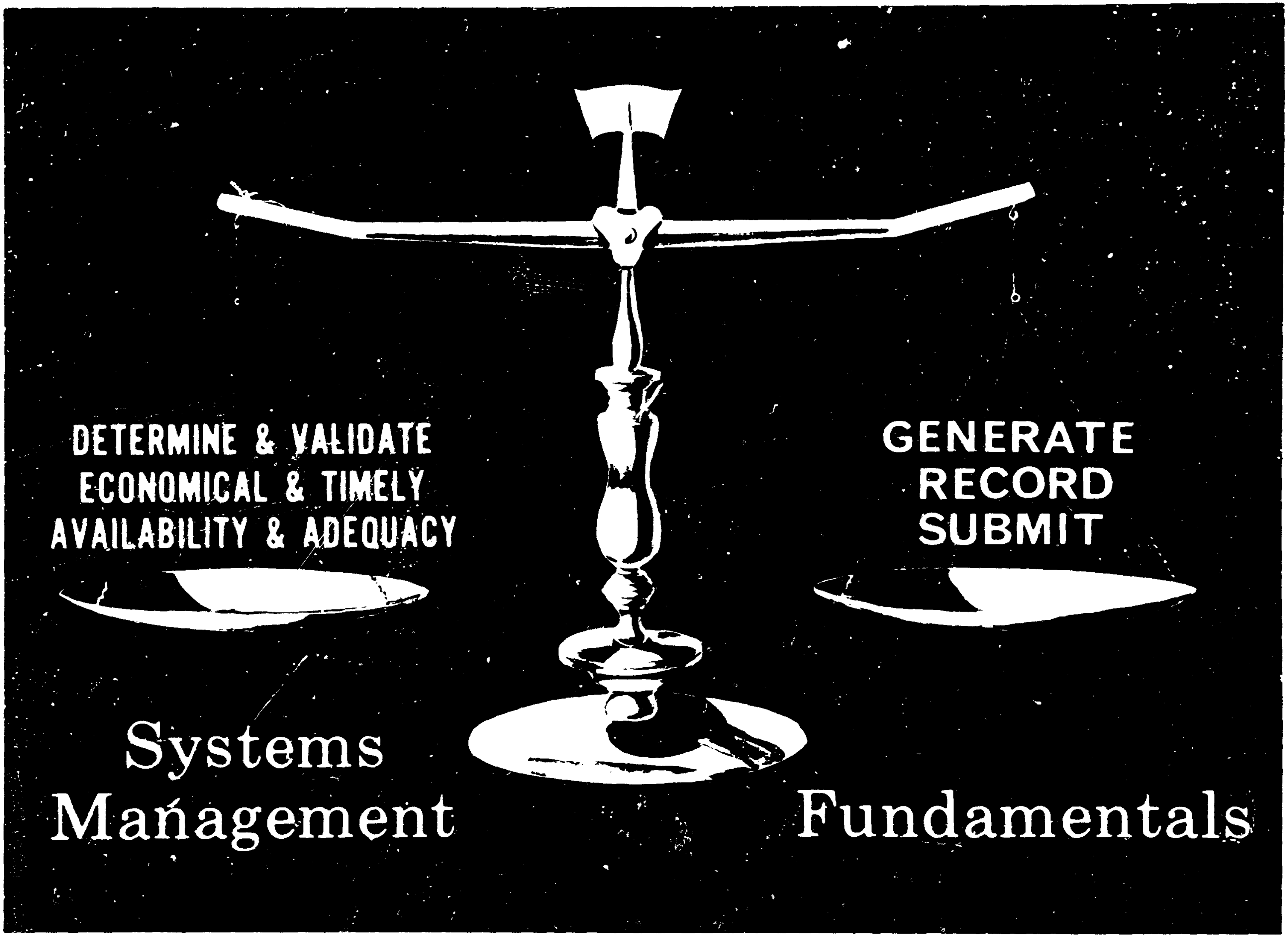
Slide #25

Until the fundamental problems associated with "generation, recording, and submission" are treated along with the basic problems associated with "determine and validate" "economical and timely", "availability and adequacy" in the documents describing data management, the job of providing customer prescribed data will continue to be difficult for industry. For industry must digest the contracts and their data requirements - separate "data" from "documentation" so to speak - and allocate each to organization, then manage the people so as to deliver the desired data, all the while communicating with the military. Both allocation and communication would be considerably improved if true recognition of fundamentals existed in all data managers, both in government and in industry.

You in government can help, gentlemen, if you will increase effort on fundamentals and publish more words which will assist in conditioning all our technicians to data needs.

A case which illustrates this point is MIL-D-1000 with its three forms and ten categories of drawing. It certainly lends itself to the selection of a set of drawings for one or all steps in the logic diagrams for weapon system acquisition and operation - but, there are those among us in industry who believe that MIL-D-1000 loses sight of the fundamental role of a drawing which is simply to serve as a medium for communicating the final design decisions of engineers to others who will take action to achieve what is described thereon. That drawings are created at a discrete point in the development cycle and this cannot be compromised if they are to remain an effective means of communication. And in this light, drawings cannot be an efficient medium for collation of all information describing all actions in weapons system acquisition and operation for all phases of time.

We must establish balance between system management and fundamentals in educating our people in line assignments who generate data, and record it to create documents to send to the government. In saying this I am fully aware that the data item description document - that is: the form 9, the 1107 form, or whatever the data item description document is - is primarily intended to speak to the generator and recorder of data in the contractor's organization and that the requirement for these forms to adequately describe the characteristics and preparation of the data item rings out loud and clear in the various policy documents prescribing their use. I am also aware that many of these same policy documents - regulations - seek self-sufficiency in the data item description document to the compromise of existing basic standards and specifications. The effect of this has been to destroy the fundamentals to which all of us have worked for many years in favor of facilitating a systems approach to acquisition of data. The data item description documents called for on the CDRL are really not so constituted as to be able to describe the data required without calling on basic documents - MIL-STANDARDS-. In addition, the data item description document may describe an uncoordinated "U" item or modified "M" item of data. - In many of our contracts, over half of the item descriptions are in this category.


DETERMINE & VALIDATE
ECONOMICAL & TIMELY
AVAILABILITY & ADEQUACY
GENERATE
RECORD
SUBMIT
Systems
Management
Fundamentals

Slide #25

Slide #26

The need for self-sufficiency and resulting proliferation of data item descriptions has created a situation that is analogous to a house which has the first floor so loaded as to cause the foundation to crumble.

Slide #27

Think for a moment of the effect that all of the energy being expended on the preparation of data item description documents would have if it were channeled to preparing basic standards describing minimum essential characteristics of documents so as to make the data conveyed by them acceptable to all agencies of the government. We could all then work to a common base. The 1107's, the forms 9 and the others would then serve only to tailor requirements when deviation is required. They would remain in effect only for the life of a specific contract and would be subject to careful scrutiny by data review boards before issuance. As data item description documents are now prepared and used, they seem to be almost exclusively instruments for variation, which are consuming the foundation from which they originated and on which they are dependent. And unless it is brought under control, the data management house will sag.

Slide #28

In my previous discussions of the contractor's organization, I identified three areas of interest to data management in the organization. One interest at a top management level; a second within the functional department which is responsible for the generation of data and the recording of that data in documentary form; a third interest is in the program management area where a data manager or a data program specialist is located so as to interface with the customer's data management office. You will notice that I have referred to these areas within the organization as of interest to data management. I have deliverately not said that any of these is data management. I believe that data management is the responsibility of all of them - each according to his functional responsibility. Perhaps the following can best describe the task of data management in a contractor's organization.

Slide #29

This task consists of the following:

(1) Recognizing data requirements which are significant to the company and the customer,

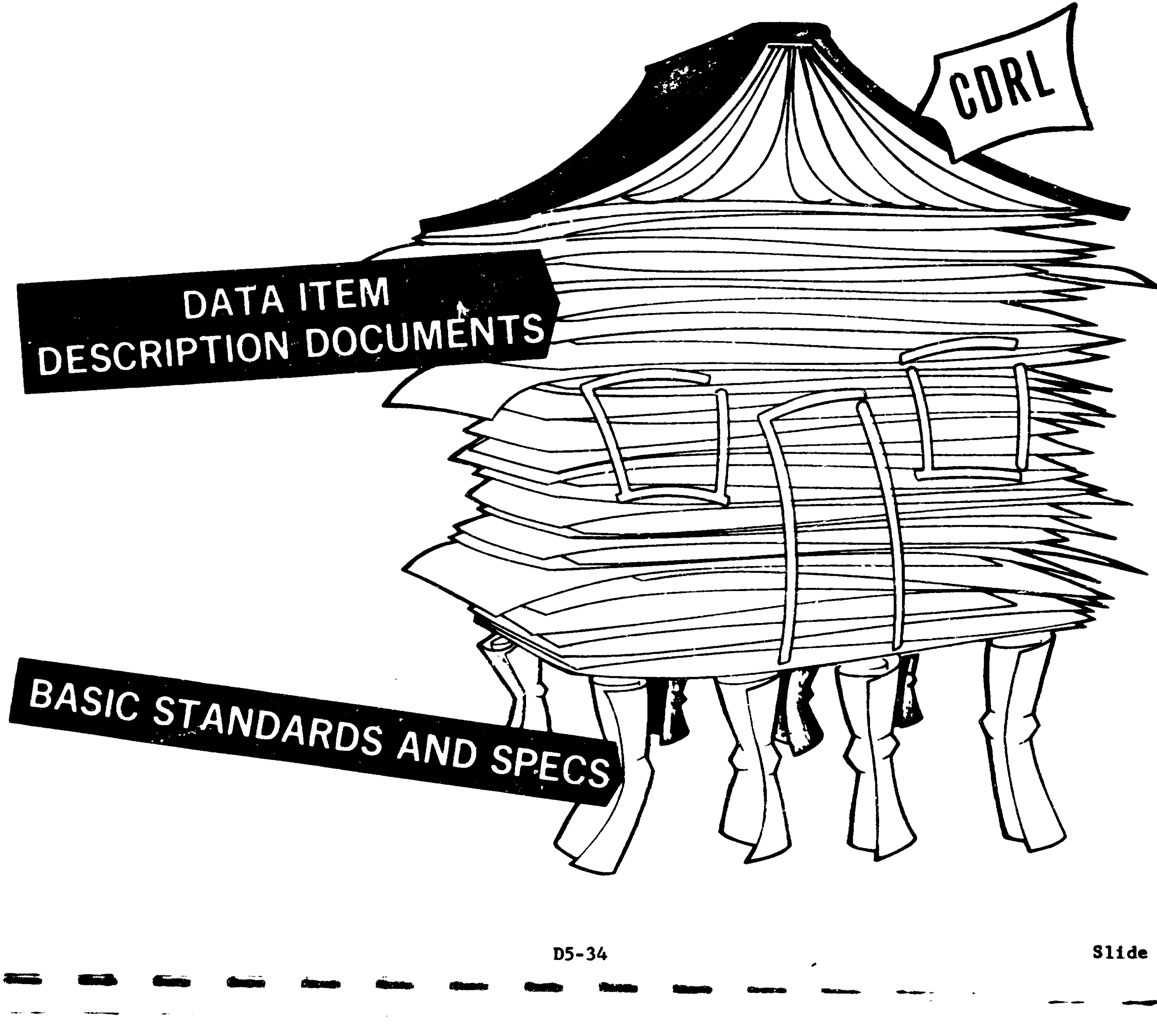
(2) Establishing facts relating to the generation and use of these data for purposes of contracting with the customer,

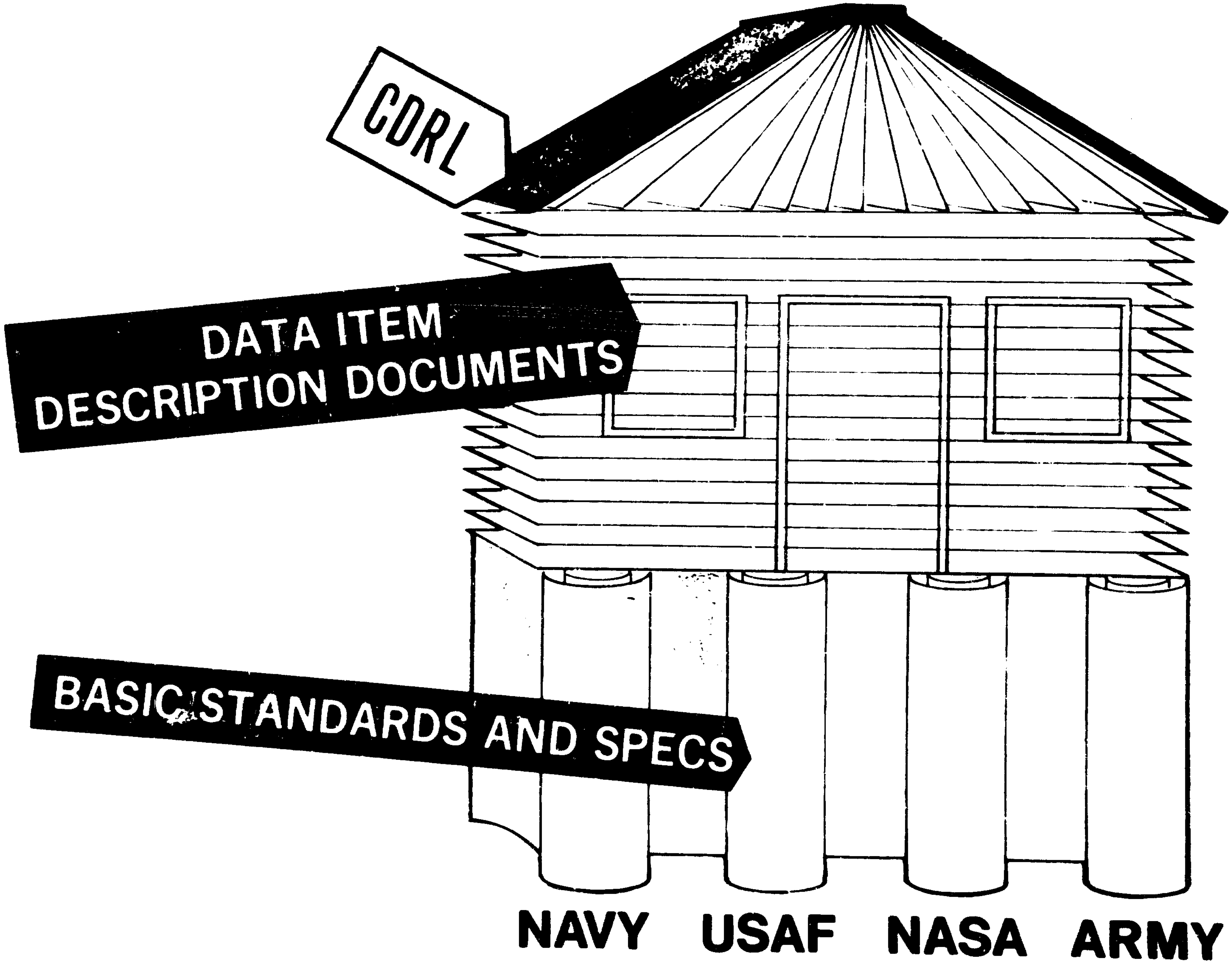
(3) Communicating these facts to management so as to permit direction through existing organizational channels,

(4) Providing knowledge of developments in data matters in government and industry,

(5) Assuring that desirable developments are put into practice, and

(6) Being prepared to verify with evidence that all contract data requirements have been met.


CDRL
DATA ITEM
DESCRIPTION DOCUMENTS
BASIC STANDARDS AND SPECS


CDRL
DATA ITEM
DESCRIPTION DOCUMENTS
BASIC STANDARDS AND SPECS
NAVY
USAF
NASA
ARMY

Slide #27

DATA MANAGEMENT AND THE PRIME CONTRACTORS ORGANIZATION

1 Recognize Data Requirements

2 Establish Facts

3 Communicate Facts to Management

4 Provide Knowledge of Data Developments in Government and Industry

5 Assure Use of Desirable Developments

6 Verify the Accomplishment of All Contract Data Requirements

This description of the task of data management can be equated to organizational responsibility. Start by recognizing the basic responsibilities of your organization and these, as we have said, correlate closely to the treatment of the difference between data and documentation previously described. It _is_ the responsibility of the functional departments to generate the data which is recorded to become documents. It _is_ their responsibility to see that these documents are timely, accurate, and are prepared at minimum cost. No one in this room questions but that it is the responsibility of the engineering department to prepare the drawings which describe the designs which are developed by the engineering department under the terms of the contract. It is certainly not the responsibility of the data manager assigned to a program office. On the other side of the nickel, there is need for a program data manager in the contractor's organization who can represent the specific program requirement of the customer to the contractor's functional organization. And it would be indeed naive to believe that the program data manager always aligns with the functional or line organization who is responsible for developing and recording the data. So the third echelon of data management comes into being. This third echelon, of course, is the top management which is responsible for establishing the policy under which both of these operations work.

Slide #30

In this next slide, I have allocated basic responsibilities to each of these interests by using the items making up the task of data management which I mentioned earlier.

How do we go about accomplishing this task as defined and assigned? The method will vary from contractor to contractor, but the elements will remain the same. The primary variance will be in the departmental source of people assigned to given functions. It is not the purpose of this paper to tell you how we do it or how you should run your shop - even if I could do so without knowing your contracts - your functional organization or your organizational personality. Rather it was intended to analyze data and data management as we have come to know them and see what this means to the contractor's organization.

Slide #31

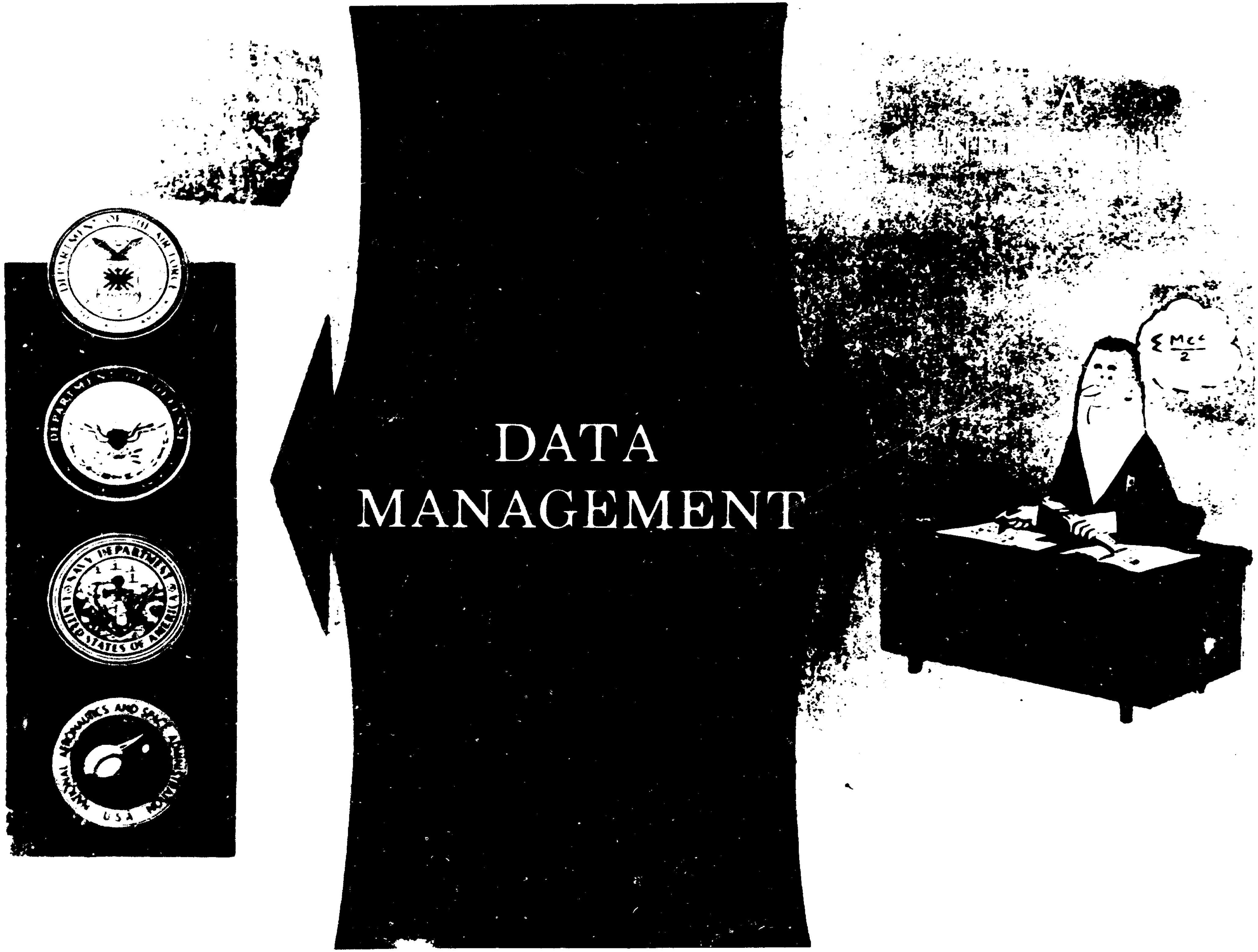
I have come to the conclusion that the fundamental difference between data management in industry and government is in the relation of _acquisition_ to _generation_;

Slide #32

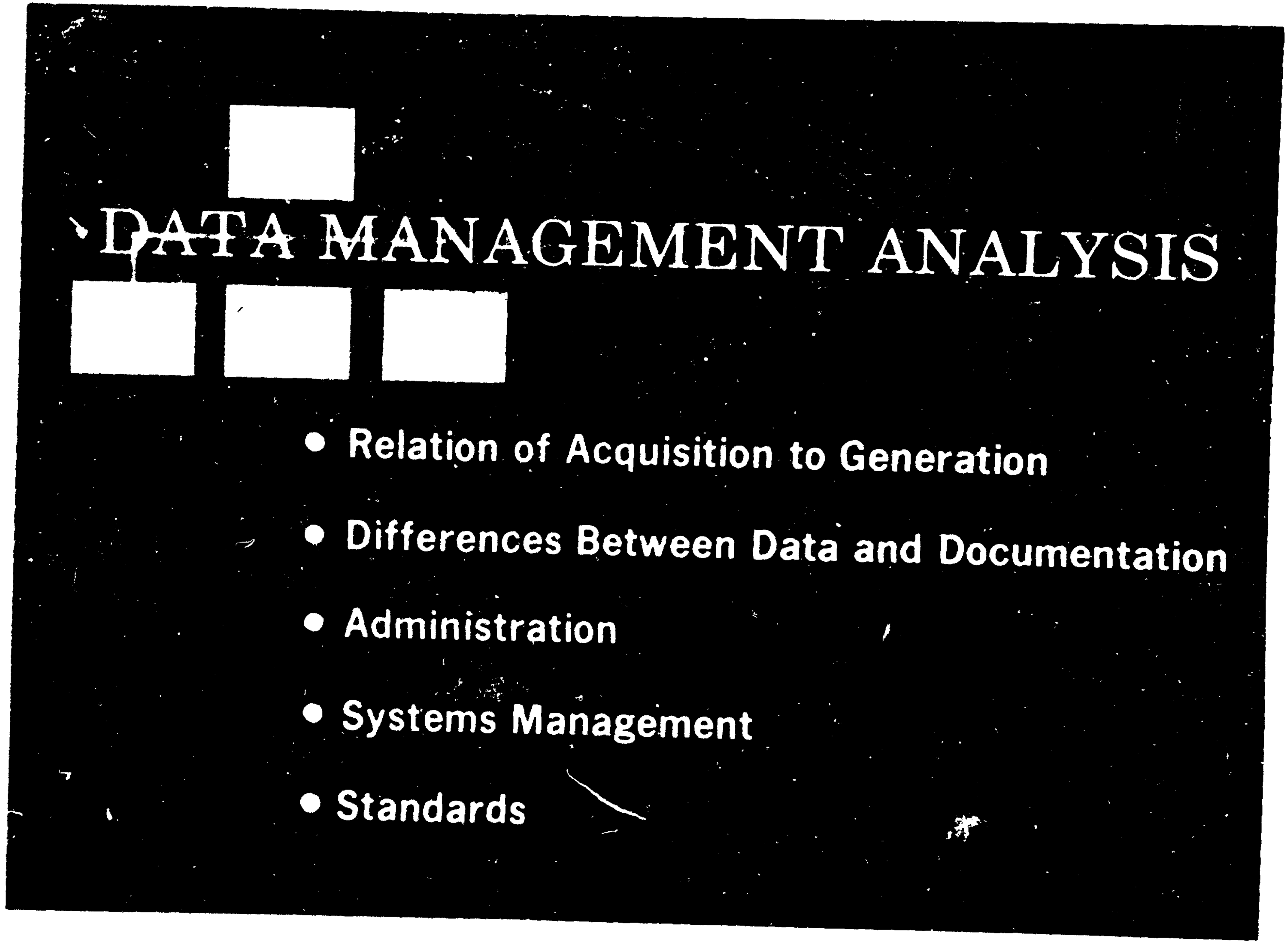
That _there is need to recognize the difference between data and documentation_ for these require different assignments and inputs; that the combination of administration of the elements of data generation and documentation acquisition under policy developed by top management is truly data management in the contractor's organization and that these factors are not necessarily apparent from much of the published words on data management today - that much of this literature in appeasing system interests does not show enough recognition of the personality and feelings of the true source of data - the creative talents. That much remains to be done in the area of standardization to correct for this by the government and industry. We must bridge this gap for it is they, the creative talents, who in the last analysis must satisfy the need for reporting with documentation at the least possible disruption to the technical processes which generates the data and furnishes the documentation as a by-product of that process.

DATA MANAGEMENT'S TASK IN A CONTRACTORS ORGANIZATION

	PROGRAM	LINE	CORPORATE
1 Recognize Data Requirements	X		X
2 Establish Facts	X	X	
3 Communicate Facts to Management	X	X	
4 Provide Knowledge of Data Developments in Government and Industry	X	X	X
5 Assure Use of Desirable Developments	X	X	X
6 Verify the Accomplishment of All Contract Data Requirements	X	X	



Slide #31


DATA MANAGEMENT ANALYSIS
• Relation of Acquisition to Generation
• Differences Between Data and Documentation
• Administration
• Systems Management
• Standards

Slide #32

QUESTION and ANSWER SESSION

D6

Moderator: Joseph Mazia

Panelists: Colonel Charles T. Campbell
Lt. Colonel William O. Rennhack
Lt. Colonel Edwin G. Triner

QUESTION	In the contract definition phase, do you "scrub" authorized and unauthorized data items one by one?
LT. COL. RENNHACK	In the Air Force we do and on the C5A for example, during the Phase 2 acquisition contract, the 1423 is comprised of the list of all the Form 9's which have data justification sheets on every Form 9 back-up. On some of the other contracts, Volume 1 of 310-1 states that justification will be prepared for and may be placed on the back of the DD 1423 or the Form 9, if it is a "U" Form 9.
COL. CAMPBELL	Very simply, we have the same requirement in the Army.
QUESTION	Will the identification requirements of 375-1 as regards the family suffix part number be applied to computer-aided design?
LT. COL. TRINER	You are concerned with family identification and codification of same. As far as the presentation that I have given of making information available, the only change that we envision will be the incorporation of an abstract of the Part 1 specification which will very distinctly provide the design agency with the information of performance characteristics contained in that specification.

E. FRIDAY MORNING SESSION - APRIL 29, 1966

INTRODUCTION

This section contains the following papers, reports and panel session presented on Friday morning; Presiding Chairman, Jay S. Crawford; Recording Secretary, Kyle G. Seipp.

- Development of Documentation Time Standards, and Implementation of Appropriate Controls,
  by Edward A. Schnabel

- Rights in Data - Past, Present, and Future,
  by Denham S. Scott

- Graphic Trends in Engineering Education,
  by Professor Edward W. Jacunski

- A Report on the DoD Data Management Course,
  by Lt. Colonel Sydnor J. Borden

Micro-Reproduction (EDMS)
Specifications and
Standards Panel
Moderator: E. Ingles

- Information on New Procedures,
  by Paul R. Durr

- Operation of Microfilm System,
  by Parker H. Daggett, Jr.

- Status of the DoD Engineering Data Micro-Reproduction System,
  by Frank R. Borden

- Technical Study Project on Use of Document Line Density,
  by Frank R. Borden

- Report on Variables Imposed by Slash Sheets and Interpretive Documents,
  by Joseph V. Symanoskie

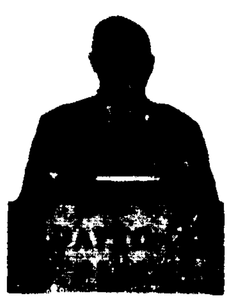
J.S. CRAWFORD
PRESIDING CHAIRMAN

K.G. SEIPP
RECORDING SECRETARY

E.A. SCHNABEL

D.S. SCOTT

PROF. E W. JACUNSKI



LT. COL. S.J. BORDEN
USAF

E. INGLES

F.R. BORDEN

P.R. DURR

P.H. DAGGETT, JR.

J.V. SYMANOSKIE

E1

DEVELOPMENT OF DOCUMENTATION TIME STANDARDS AND IMPLEMENTATION OF APPROPRIATE CONTROLS

Edward A. Schnabel
Administrator, Overhead Controls
RCA Staff

INTRODUCTION

Radio Corporation of America is keenly aware of the continuing need for establishing improved methods of labor cost control through job measurement and task definition. Time standards for scheduling, cost estimating, and assessing manpower utilization for the many production operations have been extensively employed for a good many years. Additionally, a formalized Engineered Standards Program has been adopted and promoted throughout the Company to strengthen similar techniques of measurement and controls within the many indirect and supporting activities.

Today's discussion deals with an actual application of the Engineered Standards Program within the area of engineering documentation. The intent of this particular application, which became operational during 1965, was to develop an equitable and uniform approach for measuring and controlling the work content of each activity within a drafting function. The drafting activities are comprised of the basic tasks involved in the complete documentation of a part, assembly, or system.

Early in 1965 a general review of several drafting organizations, both internal and external to the Company, indicated that not too much had been done in the way of developing and applying realistic and consistent "target times" for the myriad of drafting and checking tasks being performed. The primary reason for this, we found, appeared to be the highly variable content of the drawings themselves. For example, in addition to the type of drawing (i.e., assembly, detail part, schematic, logic, etc.) other variables introduced as the result of specific program design criteria, program documentation requirements, and established drafting room practice can have a significant effect on drafting and checking times.

To be meaningful then, a time standard for each category of work performed would necessarily have to be established with a common reference point, and using this reference point, flexibility maintained in order to compensate for major variations in task content. In other words, the complexity, class, type, etc., of the drawings must be considered in order to arrive at an equitable and attainable time standard. Additionally, the time standard must provide for an acceptable quality of workmanship.

In order to make the remainder of the presentation more meaningful, a series of explanations, appropriately illustrated, have been prepared to highlight each phase of the program from planning to implementation. Sequentially, these include Planning and Data Collection, Data Analysis, Standard Time Data Development, Example Tables of Standard Times, Controls, and Program Summary.

PLANNING AND DATA COLLECTION

The organization initially selected for the pilot project, in addition to being receptive to implementing the Engineered Standards Program, had a diversified number of programs representing both commercial and military products. Specific project objectives were established and agreed to as follows:

Objective 1. Develop an appropriate range of time standards.

- Task level measurement
- Simple to complex drawings (all types and classes)
- Consistent degree of accuracy

Objective 2. Develop an adequate means of applying the standards.

- Method of classifying standard units of work
- Compatability with existing standard practices

- Data collection procedure to summarize work performed

Objective 3. Develop and implement a performance evaluation system.

- Classify and account for all hours worked
- Provide necessary reporting levels -- employe, group, department
- Performance and costs based on "Standard Hours" produced

In view of the many variables to be determined, a comprehensive seventeen-week functional survey was undertaken to accommodate a detailed analysis of the total drafting operation. The survey encompassed three interrelated studies, as follows:

1. Production and time distribution reporting through the media of an "Employe Weekly Record" and drawing oriented "Job Work Folders."

2. A program oriented print analysis of literally hundreds of drawings encompassing some 40,000 drafting hours expended and fully documented during the course of the survey.

3. An "Activity Sampling Study" of productive and nonproductive categories of individual endeavor.

Based on survey findings, a listing of all categories of drafting and checking activities was defined and classified in terms of the appropriate documentation requirement and related standard practice. This is to say that all productive effort was identified at the basic task or job level and further classified in such a manner as to reveal variations in task content resulting from the prescribed practice. Figure 1, entitled "Time Standards Application Diagram," readily illustrates the possible variation in basic task content depending, for example, upon the program type, drawing class, and type

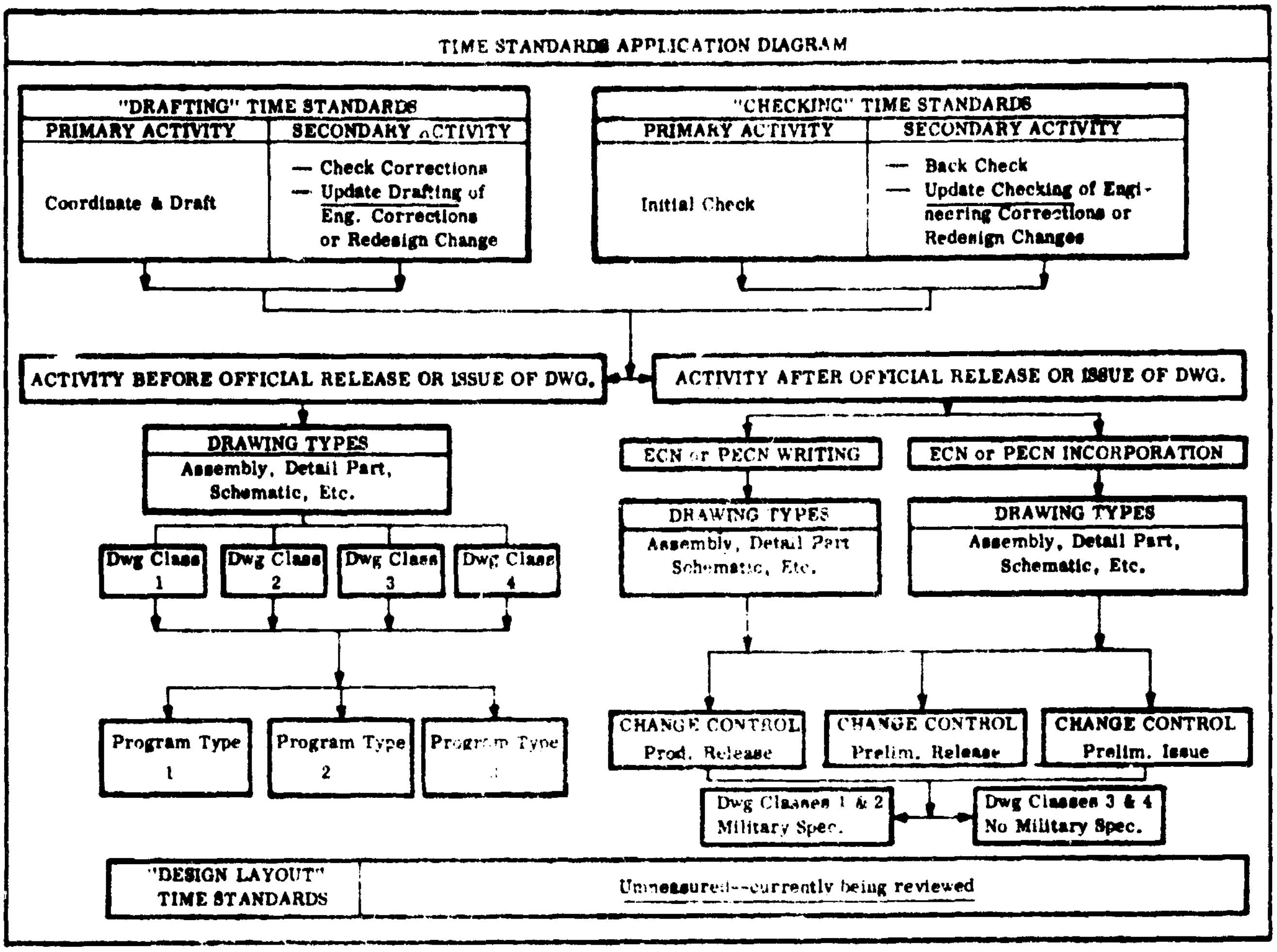


Figure 1.

of drawing. In addition, design layout effort, activity before release, and activity after release of the drawing are accounted for.

Of significance is the fact that secondary drafting and checking activities (i.e., check corrections, back check, and updating of Engineering corrections or redesign changes) are separated from the primary effort and treated as distinct and separate tasks.

For purposes of this discussion, the control definitions describing the four "Drawing Classes" and three "Program Types" are as follows:

Drawing Class 1 - MIL STD, Government Drawing Format

Drawing Class 2 - MIL STD, Company Drawing Format

Drawing Class 3 - Company Standard and Drawing Format

Drawing Class 4 - Elementary Drafting Practices

Program Type 1 - New Design and Major Redesign Programs

Program Type 2 - Minor Redesign Programs

Program Type 3 - Redress Programs

DATA COLLECTION AND ANALYSIS

Upon summarizing the myriad of classified data obtained during the survey, it soon became evident that drafting and checking times are additionally dependent upon variables other than those accounted for in Figure 1. Further inspection of the actual drawings resulted in the quantification of job complexity data common to each type of drawing. For example, each specimen drawing (i.e., assembly, detail part, schematic, logic, etc.) was examined in terms of such attributes as form size used, number of sheets, dimensions, notes, call-outs, number of views and sections, number of components, line items utilized in the bill of material, etc. These factors or attributes were then tested statistically to determine their relationship, if any, with the actual time taken to perform each stated task.

By process of elimination it was determined that at least one easily identifiable attribute per drawing type could be universally utilized to reasonably predict the time required to perform a specified drafting or checking task. Figures 2, 3, and 4 illustrate the graphical method employed in this determination. In all, some sixty "Basic Time Curves" were developed, all of which conclusively indicate that drafting or checking time per drawing is linear with respect to the selected attribute. The examples shown reveal that the selected attribute or factor varies by drawing type, and that under each specified condition the basic task is reduced to a constant time per drawing and a variable time depending upon the number of attribute units.

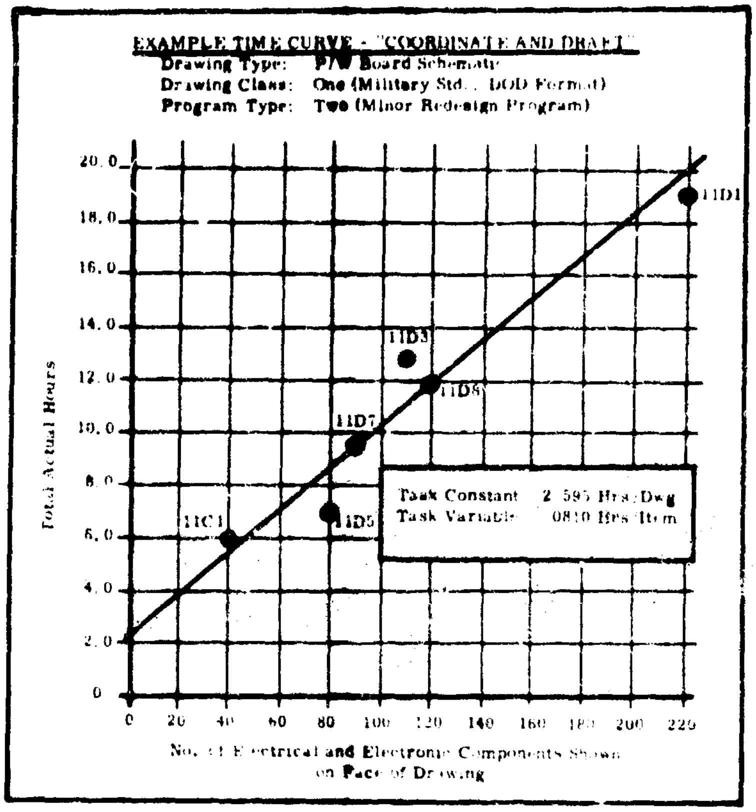


Figure 2.

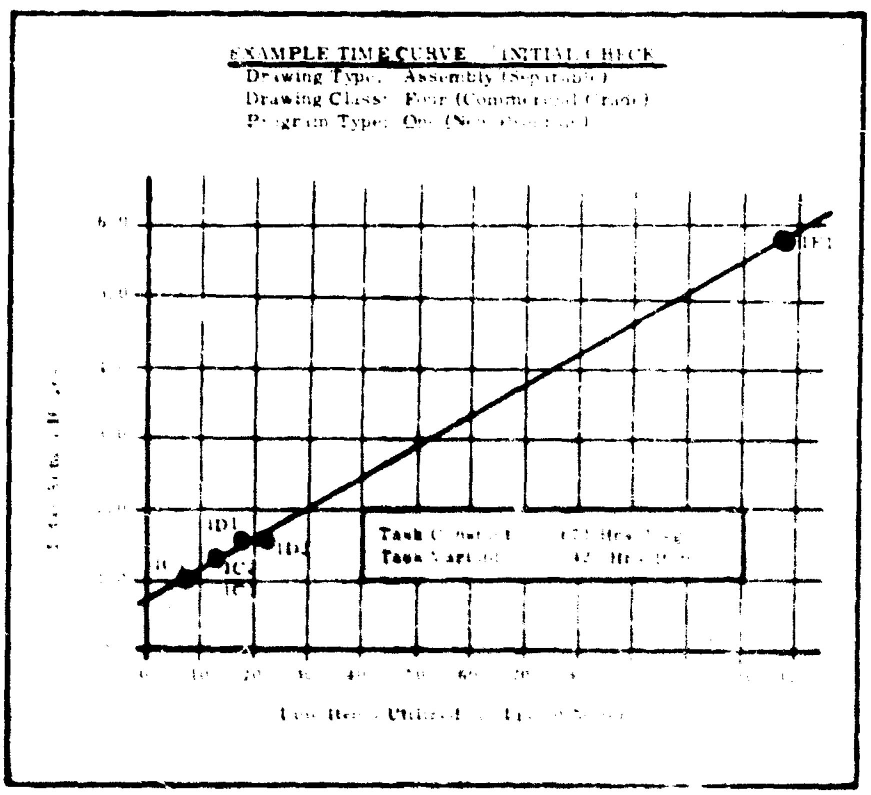


Figure 3.

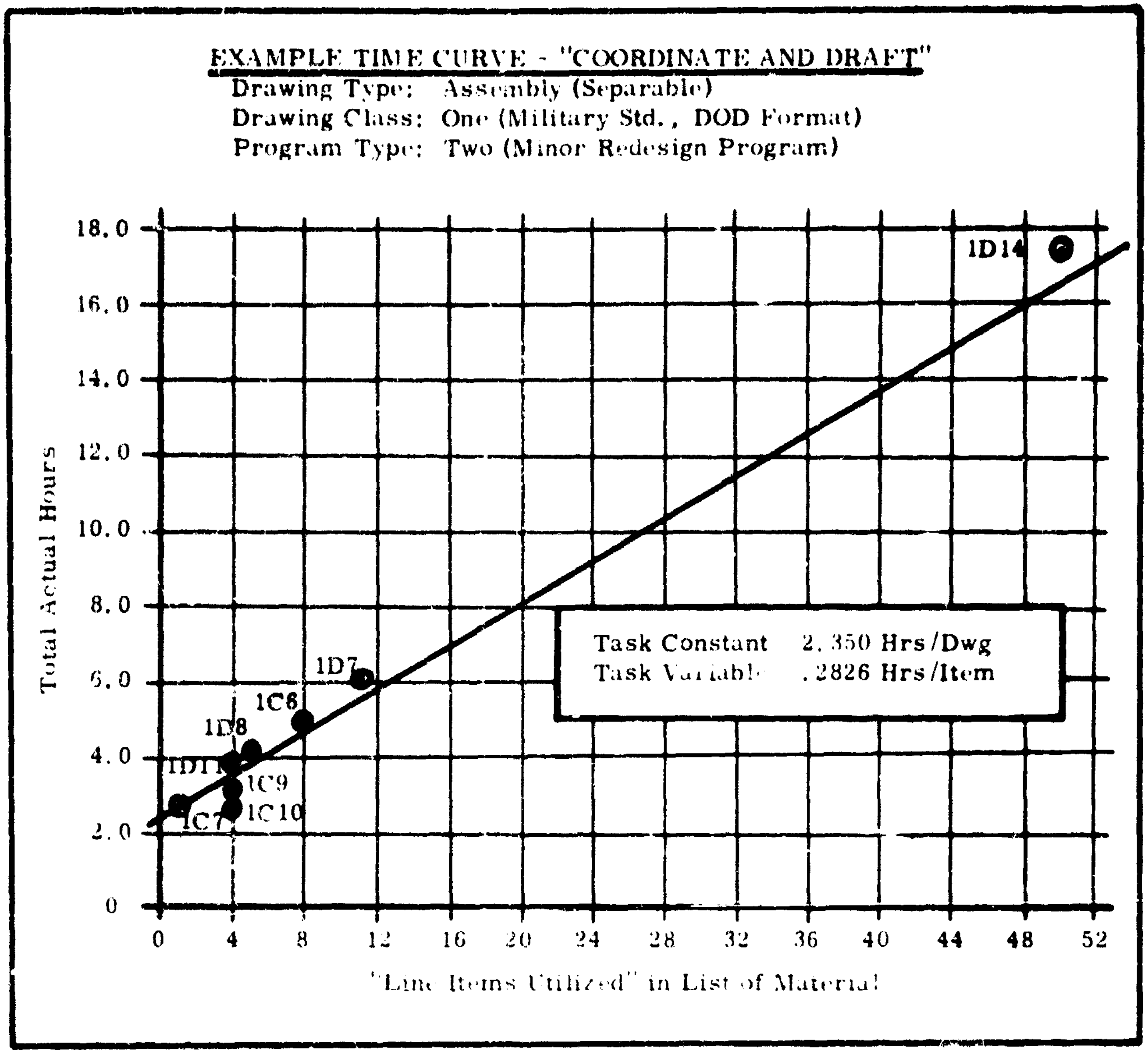

EXAMPLE TIME CURVE - "COORDINATE AND DRAFT"
Drawing Type: Assembly (Separable)
Drawing Class: One (Military Std., DOD Format)
Program Type: Two (Minor Redesign Program)
Total Actual Hours
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0
0
4
8
12
16
20
24
28
32
36
40
44
48
52
"Line Items Utilized" in List of Material
1D14
1D7
1C6
1D8
1D11
1C9
1C10
1C7
Task Constant 2.350 Hrs/Dwg
Task Variable .2826 Hrs/Item

Figure 4.

STANDARD TIME DATA DEVELOPMENT

As in all work measurement development applications utilizing the "production and time distribution reporting concept," actual elemental time values so derived must first be leveled or normalized in order to arrive at the final time standards. The reason for this is that in the reporting phase, a residual amount of nonproductive effort has been included in the recorded time. The method utilized to account for this nonproductive time was an employe-oriented activity sampling study. This study, which was conducted concurrently with production and time reporting by each employe, accounted for the following categories of individual endeavors:

Productive Activity:

a. Read/Concentrate/Examine

b. Draft/Write

c. Talk/Phone (business)

d. Miscellaneous (including handling of drawings and equipment)

Identifiable Nonproductive Activity:

e. Stand by

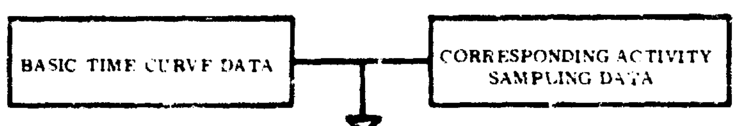
f. Talk/Phone (nonbusiness)

g. Personal

The appropriate individual "utilization factors" determined from this study provided the basis for leveling the "Basic Time Curve Data" previously explained. Figure 5 illustrates typical activity sampling statistics related to specific time curves. Figure 6, in turn, depicts the way in which data taken from the numerous basic time curves were mathematically combined with the corresponding activity sampling data to arrive at the elemental standard time values.

Typical Activity Sampling Summary Statistics Related To Specific Time Curves	
Individual Identity Code	**Range Of Leveling Factors**
V3	52.0%
H1	52.9%
V1	57.1%
H2	58.0%
V5	59.4%
H3	64.3%
D6	65.2%
V2	67.9%
V7	73.2%
D7	74.2%
V12	76.1%
H8	77.7%

Figure 5.



	ELEMENTAL STANDARD TIME DATA (From Example Time Curves)					
Basic Activity Or Task	Coordinate and Draft				Initial Check	
Drawing Type	Assembly		Printed Wiring Schematic		Assembly	
Drawing Class	1		1		4	
Program Type	2		2		1	
Sub Task	Constant Dwg	Variable Item	Constant Dwg	Variable Item	Constant Dwg	Variable Item
Actual Hours (Curve Time)	[illegible]	2026	[illegible]	.0810	[illegible]	0429
Activity Sampling Leveling Factor	[illegible]		[illegible]		[illegible]	
Leveled Hours	[illegible]	[illegible]	[illegible]	[illegible]	482	0308
Standard Hours (With Allowances)	[illegible]	.2140	[illegible]	.0648	[illegible]	.0537

Figure 6.

At this point the elemental standard time values for the various types of drawings were graphically analyzed to quantify drafting and checking "time ratios" existing between and among the three types of programs and four drawing classes. The results of this analysis revealed that the drafting and checking time ratios for any given type of drawing are dependent upon whether the drawing is predominantly "component oriented" or "dimension oriented" in content. Figures 7 through 12 graphically illustrate these relationships as they apply to the elemental standard time values for any given type of drawing. Note that both the constant and variable time elements have been accounted for. These standard "time ratios" were later utilized to provide an expansion capability for types of drawings lacking the full range of time data.

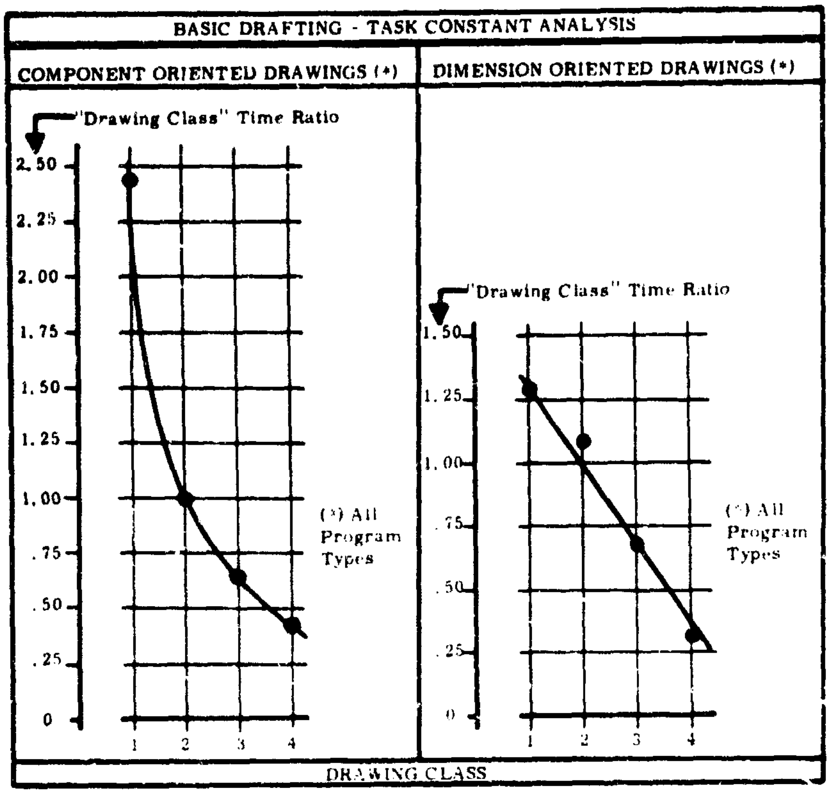


Figure 7.

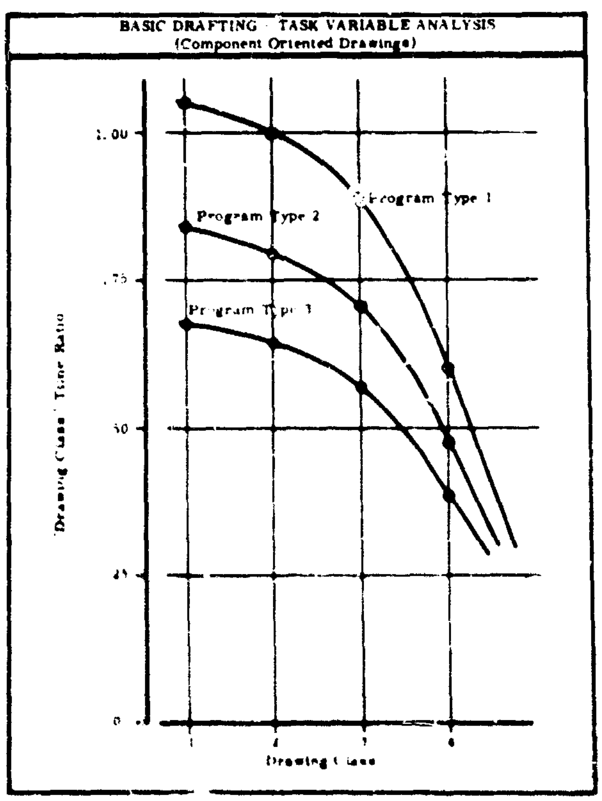


Figure 8.

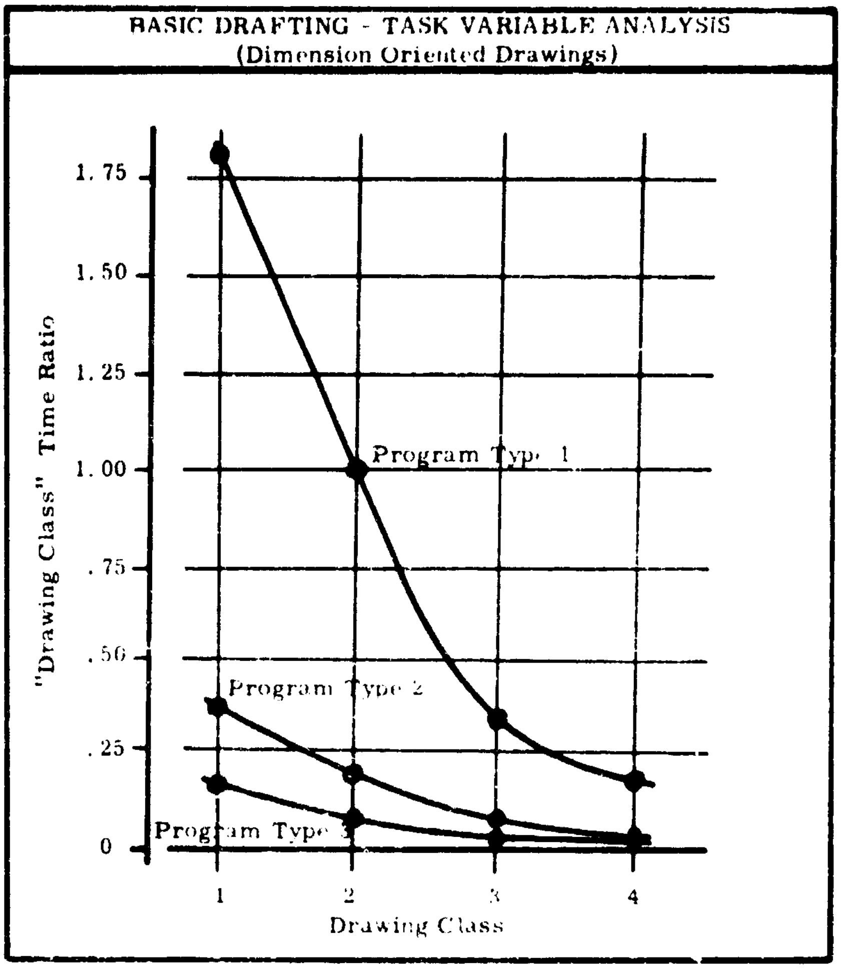


Figure 9.

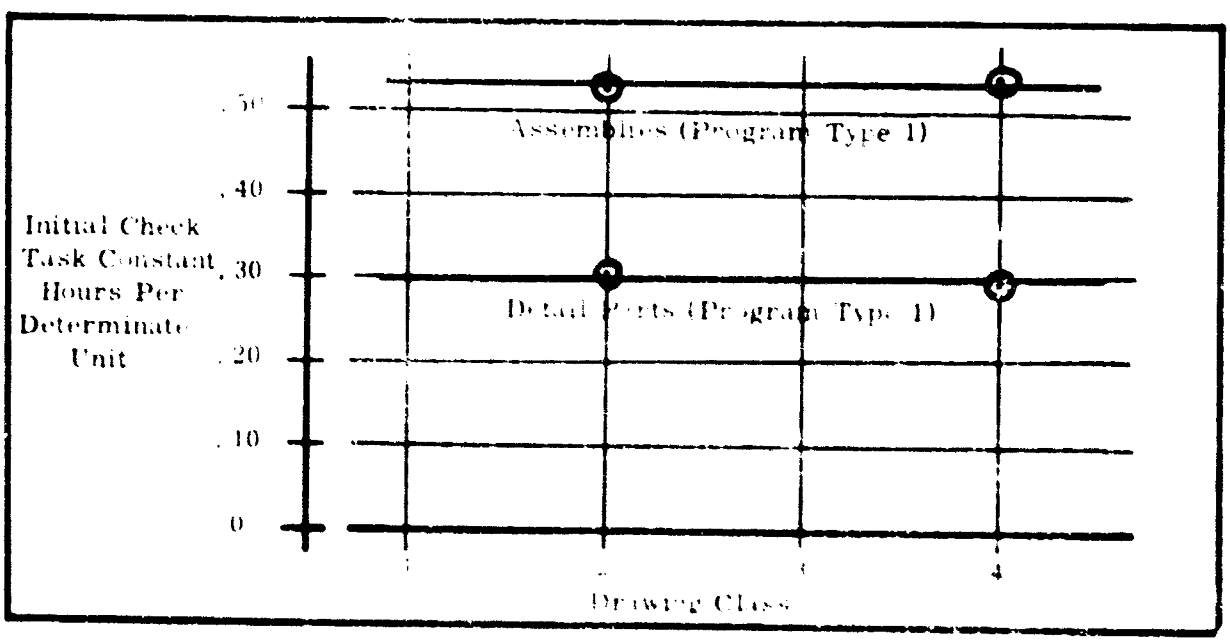


Figure 10.

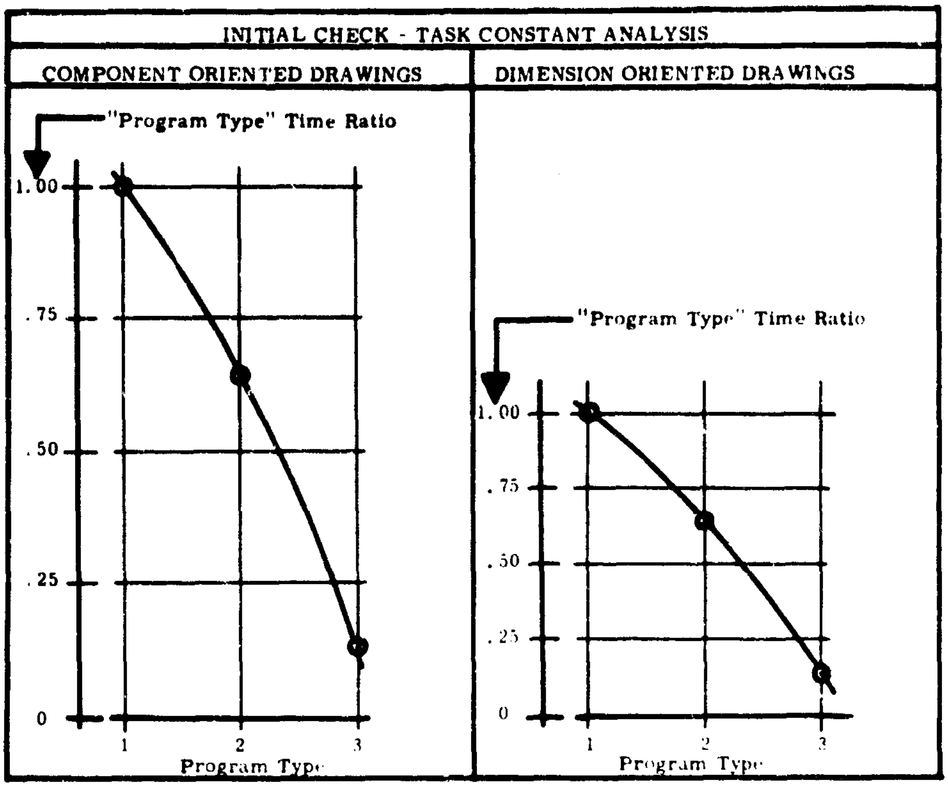


Figure 11.

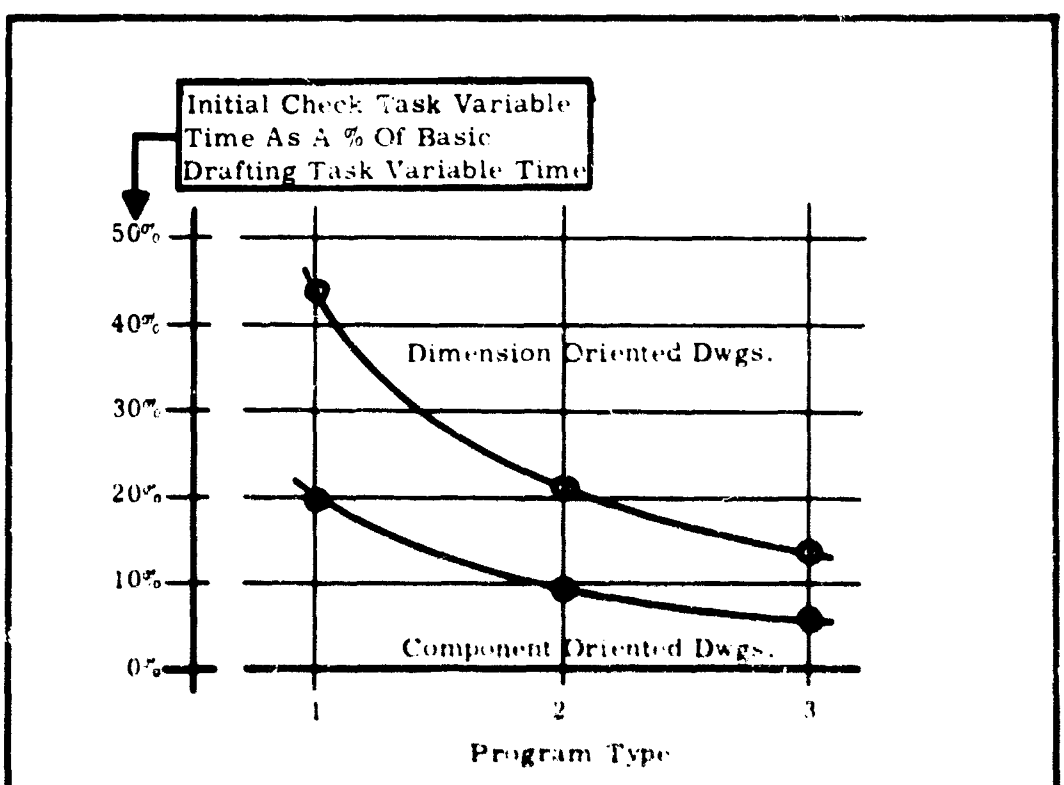


Figure 12.

The last consideration in the development phase was the amount of "check-correction" and "back-check" work being performed. Figure 13 depicts the approach taken in the determination of the standard allowance for this type of effort on drawings requiring drafting rework.

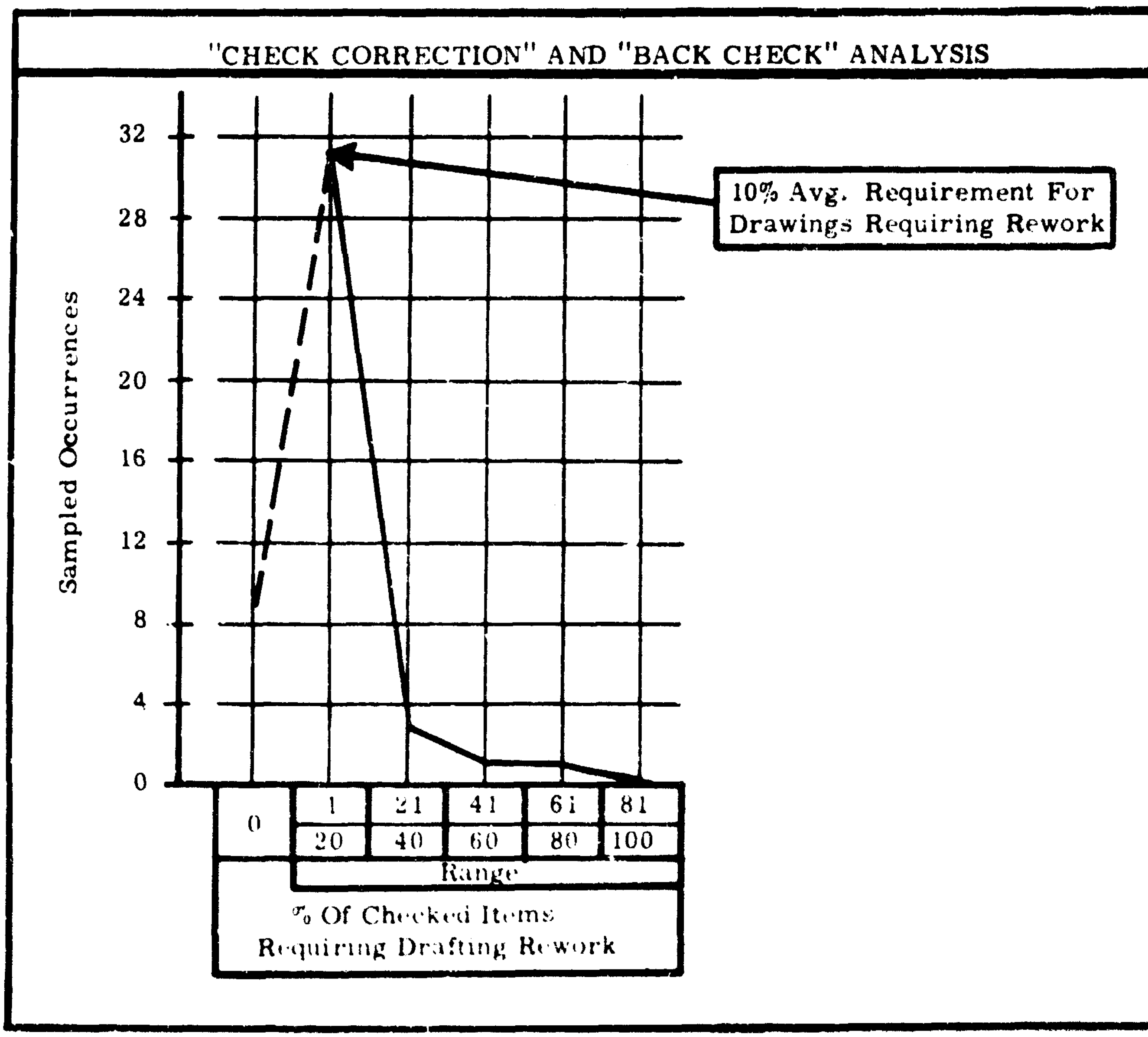


Figure 13.

EXAMPLE TABLES OF STANDARD TIMES

Upon completing the standards development phase, tables of drafting and checking target times were prepared for each of the various types of drawings. Figure 14 identifies the actual types of drawings covered and further indicates the manner in which each type has been coded and identified for ease of application.

STANDARDS TABLE IDENTIFICATION L[illegible]T

"DRAFTING & CHECKING" TIME STANDARDS TABLE NUMBER [illegible]

DRAWING TYPES	BEFORE OFFICIAL RELEASE OR ISSUE OF DRAWING: Draft	BEFORE OFFICIAL RELEASE OR ISSUE OF DRAWING: Check	AFTER OFFICIAL RELEASE OR ISSUE OF DRAWING: WRITTEN [illegible]: Draft	AFTER OFFICIAL RELEASE OR ISSUE OF DRAWING: WRITTEN [illegible]: Check	AFTER OFFICIAL RELEASE OR ISSUE OF DRAWING: [illegible]: Draft	AFTER OFFICIAL RELEASE OR ISSUE OF DRAWING: [illegible]: Check
ASSEMBLY & WELDED ASSEMBLY	[illegible]	100-5	200-1	[illegible]	[illegible]	[illegible]
DETAIL PART	105-1	105-5	205-1	205-5	[illegible]	[illegible]
DIAGRAMS: SCHEMATIC WIRING DIAGRAM, INTERCONNECTING (Term. Bk. & Wire Con. Type): Photolith Assist **	[illegible]	[illegible]	—	—	—	—
DIAGRAMS: SCHEMATIC WIRING DIAGRAM, INTERCONNECTING (Term. Bk. & Wire Con. Type): No Photolith Assist (**): Linework	[illegible]	[illegible]	210-1	[illegible]	[illegible]	[illegible]
DIAGRAMS: SCHEMATIC WIRING DIAGRAM, INTERCONNECTING (Term. Bk. & Wire Con. Type): No Photolith Assist (**): Lettering	[illegible]				[illegible]	
DIAGRAMS: SCHEMATIC DIAGRAM POINT TO POINT: Chassis, Amplifier, Power Supply, Transmitter & Receiver Applications	115-1	[illegible]	215-1	[illegible]	[illegible]	[illegible]
DIAGRAMS: SCHEMATIC DIAGRAM POINT TO POINT: P.W. Board Applications	[illegible]	116-5	[illegible]	[illegible]	[illegible]	[illegible]
DIAGRAMS: SCHEMATIC DIAGRAM, BLOCK	120-1 •	120-5	[illegible] •	[illegible]	[illegible] •	[illegible] •
DIAGRAMS: WIRE ROUTING DIAGRAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DIAGRAMS: PRACTICAL WIRING DIAGRAM	126-1 •	[illegible] •	[illegible] •	[illegible] •	[illegible]	[illegible]
DIAGRAMS: LOGIC DIAGRAM: Photolith Assist (**)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DIAGRAMS: LOGIC DIAGRAM: No Photolith Assist (**): Input Output Reference Designations: Documented Prior to Drafting	[illegible]	[illegible]				
DIAGRAMS: LOGIC DIAGRAM: No Photolith Assist (**): Input Output Reference Designations: Not Documented Prior to Drafting	[illegible]	[illegible]				
[illegible] ASSEMBLY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WIRING [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
INSTALLATION: Photolith Assist (**)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
INSTALLATION: No Photolith Assist (**)	[illegible]	[illegible]				
[illegible] WIRING [illegible]: Assembly	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] WIRING [illegible]: Schematic Diagram	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] WIRING [illegible]: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] WIRING [illegible]: Master Pattern	[illegible] •	[illegible] •	[illegible] •	[illegible]	[illegible]	[illegible]
[illegible] WIRING [illegible]: Marking	[illegible] •	[illegible] •	[illegible] •	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]: [illegible] (Ref. Dwg's Only)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure 14.

Each table has been expanded in stepped time ranges appropriately gauged in terms of unit volumes of the specific attribute selected during the standards development phase. A few examples of these attributes, by type of drawing, are:

Assembly	- "Line Items Utilized in List of Material"
Detail Part	- "Total Number of Dimensions, Notes, and Call-outs on Face of Drawing"
Printed Wiring Schematic	- "Total Number of Electrical and Electronic Components Identified on Face of Drawing"
Logic Diagram	- "Total Number of Gates, State Indicators, and Electronic Components Identified on Face of Drawing"
Interconnecting Wiring Diagram	- "Total Number of Coded Wires Identified on Face of Drawing"

Figures 15 and 16 are representative examples of the many tables of target times resulting from the completed survey. In addition to providing a range of time values for primary drafting and checking tasks, the tables incorporate a consistent means of targeting secondary drafting effort such as "Check Corrections," "Back Check," and Update Drafting and Checking of Engineering Changes."

ENGINEERED STANDARDS PROGRAM	Drafting Department Time Standards		TABLE
	DRAWING TYPE(S)	SCHEMATIC DIAGRAM - Point to Point (For Chassis, Amplifier, Power Supply, Transmitter & Receiver Applications)	115-1

STD. DETERMINATE	PRIMARY DRAFTING ACTIVITY MEASURED	"COORDINATE & DRAFT"
TOTAL NO. OF ELEC. & ELECTRONIC COMPONENTS IDENTIFIED ON FACE OF DWG. (Incl. Term. Block & Connectors)		NOTE: "Prior to Release or Issue of Drawing"

		PROGRAM TYPE											
		1. NEW DESIGN OR MAJOR REDESIGN PROGRAMS				2. MINOR REDESIGN OR MAJOR DOCUMENTATION PROG.				3. REDRESS PROGRAMS			
		DRAWING CLASS											
RANGE CODE	UNIT RANGE	1	2	3	4	1	2	3	4	1	2	3	4
		TOTAL STANDARD HOURS PER DRAWING (All Sheets)											
1	0												
2	1- 2	2.0	.9	.6	.4	2.0	.9	.6	.4	1.9	.8	.6	.4
3	3- 4	2.2	1.1	.8	.6	2.1	1.1	.8	.5	2.1	1.0	.7	.5
4	5- 6	2.5	1.4	1.0	.7	2.3	1.2	.9	.6	2.2	1.1	.8	.6
5	7- 8	2.7	1.6	1.2	.8	2.5	1.4	1.1	.7	2.4	1.3	1.0	.6
6	9- 10	3.0	1.8	1.4	1.0	2.7	1.6	1.3	.8	2.5	1.4	1.1	.7
7	11- 12	3.2	2.1	1.6	1.1	2.9	1.8	1.4	.9	2.7	1.6	1.2	.8
8	13- 14	3.5	2.3	1.8	1.2	3.1	2.0	1.6	1.0	2.9	1.7	1.4	.9
9	15- 16	3.7	2.5	2.1	1.4	3.3	2.2	1.8	1.2	3.0	1.9	1.5	1.0
10	17- 18	3.9	2.8	2.3	1.5	3.5	2.4	1.9	1.3	3.2	2.0	1.6	1.1
11	19- 20	4.2	3.0	2.5	1.6	3.7	2.5	2.1	1.4	3.3	2.2	1.7	1.2
12	21- 22	4.4	3.2	2.7	1.8	3.9	2.7	2.3	1.5	3.5	2.3	1.9	1.3
13	23- 24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.9	2.4	1.6	3.6	2.5	2.0	1.3
14	[illegible]- 288	35.4	32.7	28.6	19.2	28.5	26.[illegible]	[illegible]	1.7	3.8	2.7	2.2	1.5
40	289- 317	38.7	35.9	31.4	21.0	31.2	28.7	25.6	[illegible]	4.0	2.9	2.3	1.6
41	318- 349	42.4	39.4	34.6	23.1	34.1	31.5	28.2	18.5	27.[illegible]	[illegible]	[illegible]	[illegible]
42	350- 384	46.5	43.3	38.0	25.4	37.3	34.6	31.0	20.3	30.4	28.0	24.[illegible]	16.4
43	385- 422	51.0	47.5	41.7	27.9	40.9	37.9	34.0	22.3	33.3	30.7	26.9	18.0
44	423- 465	55.5	51.8	45.5	30.5	44.5	41.4	37.1	24.3	36.2	33.5	29.3	19.6
45	466- 511	61.3	57.4	50.4	33.7	49.1	45.8	41.1	26.9	39.9	37.0	32.4	21.7
46	512- 562												
47	563- 618												
48	619- 680												
49	681- 748												
50	749- 823												
51	824- 905												
52	906- 996												
53	997-1095												
54	1096-1205												

-a	SECONDARY DRAFTING ACTIVITY MEASURED	"CHECK CORRECTIONS" (First Time Only)		.1 Std. Hours Per Drawing, Or	10%	Of Above Appropriate "Standard Hours"; Whichever of the Two Values is Greater.
-b		"FORCE DRAFTING" OF INCREMENTAL	1 - 10% Dwt. Change		5%	
-c			11 - 20% " "		15%	
-d		CORRECTIONS OR REDESIGN CHANGES	21 - 30% " "		25%	
-e			31 - 40% " "		35%	
-f			41 - 50% " "		45%	

"DRAWING FORM UTILIZATION" IN TERMS OF "STD. DETERMINATE" LISTED ABOVE							
DRAFTING PRACTICE (Typical)	Minimum	Range- 10	Range- 18	Range- 25	Range- 32	[illegible] Det. Units	[illegible]-12-65
	Average	Range- 12	Range- 19	Range- 27	Range- 34	[illegible] Det. Units	
	Maximum	Range- 14	Range- [illegible]	Range- 3[illegible]	Range- [illegible]	[illegible] Det. Units	EFFECTIVE DATE
FORM SIZE		"B"	"C"	"D"	"E"	VOLUME/"A" FORM	

Figure 1[illegible]

ENGINEERED STANDARDS PROGRAM	Drafting Department [illegible]		
	DRAWING TYPE(S)	SCHEMATIC DIAGRAM--[illegible] (For Chassis, Amplifier, Power Supply, Transmitter & Receiver Applications)	TABLE 125-5

STD. DETERMINATE: TOTAL NO. OF: ELECTRICAL & ELECTRONIC COMPONENTS IDENTIFIED ON FACE OF DWG.

PRIMARY CHECKING ACTIVITY MEASURED: "INITIAL CHECK"

NOTE: "Prior to Release or Issue of Drawing"

		PROGRAM TYPE: 1. NEW DESIGN OR MAJOR REDESIGN PROGRAMS				2. MINOR REDESIGN OR MAJOR DOCUMENTATION PROG.				3. REDRESS PROGRAMS			
RANGE CODE	UNIT RANGE	DRAWING CLASS 1	2	3	4	1	2	3	4	1	2	3	4
		TOTAL STANDARD HOURS PER DRAWING (All Sheets)											
1	0												
2	1- 2	.6	.6	.6	.5	.3	.3	.3	.3	.1	.1	.1	.1
3	3- 4	.6	.6	.6	.6	.4	.4	.4					
4	5- 6	.7	.6	.6	.6	.4	.4	.4					
5	7- 8	.7	.7	.7	.6	.4	.4	.4					
6	9- 10	[illegible]	.7	.7	.6	.4	.4	.4					
7	11- 12	[illegible]	[illegible]	[illegible]	.7	.4	.4	.4					
8	13- 14	[illegible]	.8	[illegible]	.7	.5	.5	.4					
9	15- 16	.9	.9	[illegible]	.7	.5	.5	.5		[illegible]			
10	17- 18	.9	.9	[illegible]	[illegible]	.5	.5	.5		.2	.1		.6
11	19- 20	1.0	1.0	.9	[illegible]	.5	.5	.5				.9	.6
12	21- 22	1.0	1.0	1.0	.6	.5	.5	.5			1.1	1.0	.7
[illegible]	[illegible]		1.1	[illegible]	.8	.6	.5	[illegible]		1.3	1.2	1.1	.7
[illegible]	263- 288	[illegible]							1.8	[illegible]	[illegible]	1.2	.9
40	289- 317	7.8	7.5	6.6	[illegible]	[illegible]	3.0	2.8	1.9	1.5	1.5	1.3	.9
41	318- 349	8.6	8.2	7.3	5.[illegible]	3.4	3.3	3.0	2.1	1.7	1.6	1.4	1.0
42	350- 384	9.4	8.9	7.[illegible]	5.5	3.7	3.6	3.[illegible]	2.2	1.8	[illegible]	1.6	[illegible]
43	385- 422	10.2	9.5	[illegible]	6.0	4.1	3.9	3.6	2.4	2.0	1.9	1.7	1.2
44	423- 465	11.1	10.6	9.[illegible]	6.5	4.[illegible]	4.3	3.9	2.6	2.2	2.1	1.9	1.3
45	466- 511	12.3	11.7	10.4	7.1	4.9	4.7	4.2	[illegible]	2.4	2.[illegible]	2.1	1.4
46	512- [illegible]												
47	563- 618												
48	619- 680												
49	681- 748												
50	749- 823												
51	824- 905												
52	906- 996												
53	997-1095												
54	1096-1205												

	SECONDARY CHECKING ACTIVITY MEASURED	"[illegible] (First Time Only)"				
-a		"[illegible] INITIAL CHECKING" [illegible] CORRECTIONS OR REVISION CHANGES	1 - 10% Est. Change	.1 Std. Hours Per Drawing, Or	[illegible]%	Of Above Appropriate "Standard Hours"; Whichever of the Two Values is Greater.
-b			11 - 20% " "		5%	
-c			21 - 30% " "		15%	
-d			31 - 40% " "		25%	
-e			41 - 50% " "		35%	
-f					45%	

"DRAWING FORM [illegible]" IN TERMS OF "STD. DETERMINATE" [illegible]						
DRAFTING PRACTICE (Typical)	Minimum	Range- [illegible]	Range- [illegible]	Range- [illegible]	Range- [illegible]	[illegible]
	Average	Range- [illegible]	Range- [illegible]	Range- [illegible]	Range- [illegible]	[illegible]
	Maximum	Range- [illegible]	Range- [illegible]	Range- [illegible]	Range-	[illegible]
FORM SIZE		"B"	"C"	"D"	"E"	VOLUME "A" FORM

[illegible]

EFFECTIVE DATE

Figure [illegible]

CONTROLS - GENERAL

One of the most important steps in any work measurement program is the implementation of an effective control medium. Time standards by themselves without adequate control procedures have limited value. Thus, the program in addition to providing detailed tables of targeted time for each of the various types of drawings establishes a capability for:

1. Classifying and assigning standard "drafting and checking" work packages within each project or program.

2. Measuring and evaluating work performed, both on an individual and group level basis.

3. Summarizing and relating group level weekly labor costs and performances to standard or targeted rates of production.

4. The determination of the amount of standard or targeted work backlog assigned to each employe.

A summarization of the complete reporting cycle is included in Figure 17.

CONTROLS - BASIC REPORTING CYCLE

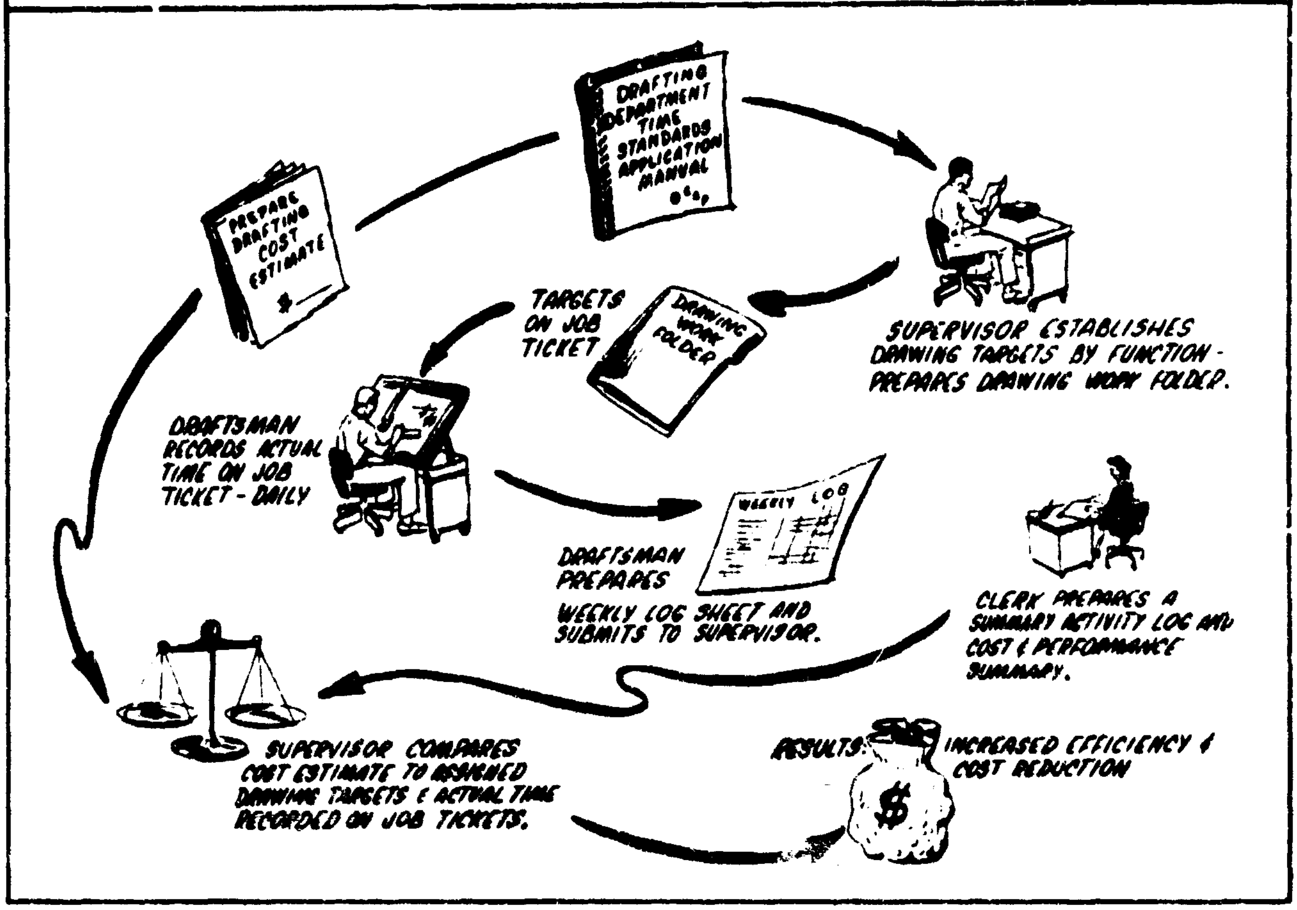


Figure 17.

CONTROLS - WORK ASSIGNMENT SYSTEM

As engineering information concerning a specific project is received by the Drafting Department, the assigned Group Leader initiates a "Drafting Job Ticket" for each required layout or drawing. Assignment folders for the listed drawings or layouts, incorporating the Drafting Job Ticket and appropriate design information and sketches, are then distributed to those responsible for their preparation.

The Job Ticket provides an appropriate "Activity Classification Code" and "Target Hours" for each of the assigned tasks based on information contained in the "Time Standards Application Manual." This serves to stimulate more effective use of available time and further provides input information for the "Employe Weekly Activity Log" which acts as the first level report in the evaluation system.

Additonal space is provided on the Job Ticket for each assigned employe to classify and record drafting or checking time subsequently taken to complete the job. Each folder is maintained, in sequence order, as a permanent record in the system files and provides a breakdown of hours by activity for future reference at project level. A "Drafting Job Ticket Log" provides a substantially condensed means of classifying, targeting, and assigning ECN work in a manner similar to the original drafting and checking tasks. The ECN Drafting Job Ticket Log permits the batching of ECN's to be incorporated so that the drafting and checking tasks performed on a total of ten drawings can be classified and recorded on one sheet.

CONTROLS - EVALUATION SYSTEM

The evaluation system incorporates three levels of reporting as follows:

Level One Reporting - "Employe Weekly Activity Log"

The employe record of daily activities provides the input into the final reporting system. The log affords a convenient one-page summary of each individual's weekly productive output as identified and classified in the completed Job Tickets. In addition, the log summarizes the following weekly distribution of individual hours worked:

Labor Category	Description
Code 2	Productive Time - Measured Drawings and Layouts
Code 3	Productive Time - Unmeasured Drawings and Layouts
Code 4	Nonstandard Time - Miscellaneous Coordination - Nondrafting Tasks - Group Meetings
Code 5	Delay - Wait for Assignments - Wait for Instructions

The Group Leader performs an audit review of each log for completeness and accuracy in advance of posting to the Summary Activity Report by the group clerk.

Level Two Reporting - "Summary Activity Report"

The motivation for increased performance and reduction of excess costs originates with line supervision. To assist in this regard, a summarized weekly production report, based on audited input from the Employe Weekly Activity Logs, is prepared to account for the expenditure of group labor hours by labor category and employe. The cognizant Group Leader utilizes this report as a means of determining if the rate of output is low or decreasing and, where required, applies greater supervisory effort in order to improve productivity. The report also serves to keep the Group Leader posted on the amounts and sources of nonproductive time which, if excessive, should be studied in detail so that corrective action can be taken.

Information displayed in the Summary Activity Report as depicted in Figure 18 includes the following information:

a. Deployment of hours (by employe and group) for each of the four labor codes, plus Group Leader and Assistant Leader hours.

ENGINEERED STANDARDS PROGRAM	SUMMARY ACTIVITY REPORT	
	DIVISION: XYZ	Week Ending
	ACTIVITY: 123	7-10-65
	GROUP/SECTION: DRAFTING GROUP 4	
	SUPERVISOR: G. LEADER	Page 1 of 1

Column Ref.	"p"	"q"	"r"	"s"	"t"	"u"	"v"	"w"
		Distribution of Available Hours						
Employe	Total Available Hours (*)	Lead	Un-Meas. Prod.	Non-Standard Work	Delay	Measured Prod.	Total Standard Hours Earned	Perf. to Std. (%)
		Labor Code Ref. No.						
		1	3	4	5	2		
R. GARNER	40.0		4.0	3.5		32.5	26.3	81%
J. FARMER	40.0		10.0		.5	29.5	22.7	77
G. WHITE	40.0			1.5		38.5	29.3	76
R. BLACK	40.0			2.0		38.0	27.4	72
Y. BROWN	40.0			.5		39.5	28.0	71
Z. RED	40.0					40.0	26.8	67
N. GREEN	40.0		6.0	2.5		31.5	19.8	63
W. PINK	40.0					40.0	24.8	62
G. LEADER	40.0	40.0						
Group Totals	360.0	40.0	20.0	10.0	.5	289.5	205.1	

* Gross (Straight Time) Hours Logged to Activity, Less Approved Time Off Job.

Column Reference		
"z"	"y"	"x"
Group Percentages		
Stds. Coverage	Admin. Rating	Avg. Perf.
94%	68%	71%

Figure 18.

b. Individual and group performances while on measured work.

c. "Administrative Rating" of Group Leader relative to the amount of time lost to delays and nonstandard work (Labor Codes 4 and 5).

d. "Standards Coverage" index to indicate the amount of productive activity that is currently being measured in the reporting group.

Level Three Reporting - "Cost and Performance Summary"

The Cost and Performance Summary is designed for use by second level (and above) operating management. As its title implies, the report provides the manager a summarization of labor expended within the measured operating unit. It highlights the utilization of employe hours and expresses the various categories of excess labor cost as a ratio to the "standard cost dollar."

Visibility afforded by the summary directs the manager's attention to those factors which are producing excess cost and, in turn, enables him to take corrective measures on high cost elements.

Information displayed in the Cost and Performance Summary, illustrated in example Figure 19, includes the following data on a consecutive weekly basis:

a. Group Percentages

Standards Coverage

Reflects the degree of all drafting and checking effort that is measured based on the mix of measured and unmeasured drawings during any given week. A low or reducing Standards Coverage indicates additional service is required from the responsible work measurement engineer.

Administrative Rating

Reflects supervisor's ability to hold "Delay" and "Nonstandard Work" to a minimum and productive output high. Best if equal to "Average Performance."

Average Performance

Performance of all employes while working on measured operations.

b. Total Target Hours Earned

Reflects the total standard production during the reporting period. This is arrived at by applying the "Standard Target Time" to each unit of work

ENGINEERED STANDARDS PROGRAM

COST AND PERFORMANCE SUMMARY		
DIVISION	ACTIVITY	GROUP OR SECTION
XYZ.	123	DRAFTING GROUP 4

	Group Percentages				Cost Ratios in Excess of Std. Cost						Financial Gain or (Loss) From Base			Goal Cost Analysis	
					Labor Code Ref. No. 1	2	3	4	5			Savings			
Week Ending	Stds. Cover-age	Admin. Rating	Avg. Perf.	Total Standard Hours Earned	Lead	Sub-Std Perf.	Un-Meas. Prod.	Non-Std. Work	Delay	Total	Group Avg. Hourly Rate	Current Week	Cum. to Date	Var. Cost Ratio	Equiv. No. (Over) Under
Base 6/12	92%	54%	60%	219.6	.18	.66	.15	.17	.02	1.18	3.95	–	–	.82	(4.5)
6/19/65	92	52	59	213.0	.19	.59	.15	.21	.02	1.26	"	($67)	($67)	.90	(4.8)
6/26	93	59	64	219.5	.18	.56	.12	.2	.01	.99	"	165	98	.63	(3.5)
7/3	94	61	65	206.7	.19	.54	.10	.09	.01	.93	"	204	302	.57	(2.9)
7/10	94	68	71	205.1	.20	.41	.10	.05	.00	.96	"	340	642	.40	(2.1)
Goal 6/12	95%	85%	90%	Varies	.12	.11	.06	.06	.51	.36					
Col. Ref.	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	"K"	"L"	"M"	"N"	"O"

Figure 19.

produced. The Total Standard Hours Earned is utilized as the "common denominator" of all Labor Categories to provide a means of expressing labor cost ratios in excess of the standard cost ratio of 1.00.

c. <u>Cost Ratios in Excess of Standard Cost</u>

The Cost Ratios indicate the current cost according to the five labor categories. They show the ratio of each labor category hour to each standard hour earned.

<u>Lead Cost Ratio</u>

This indicates the relative cost in excess of standard due to Planned Lead Time. The ratio serves as a sensitive indicator for lead staffing purposes.

Substandard Performance Cost Ratio

Reflects the relative cost in excess of standard due to performances below 100% on measured productive work.

Unmeasured Productive Cost Ratio

Reflects the relative cost in excess of standard due to time spent on productive work not covered by standards.

Nonstandard Work Cost Ratio

Reflects the relative cost in excess of standard due to time spent on assigned activities other than "Drafting and Checking" of drawings and layouts.

Delay Cost Ratio

Reflects the relative cost in excess of standard due to time spent on "waiting for work" or "instructions."

Total Cost Ratio

This is arrived at by summing all individual Cost Ratios.

d. Financial Gain or Loss from Base

This indicates the dollars gained or lost in comparison to the predetermined "Base" (or starting) excess cost value.

Group Average Hourly Rate

Represents the average straight time hourly earnings of the organization being measured (including Lead Labor).

Current Week Savings (or Loss)

Gain or loss each week.

Cumulative Savings (Loss) to Date

Total gain or loss from date of installation of standards.

e. Goal Cost Analysis

Provides a conversion of the total cost ratio in excess of standard into a related variance in work force from the "predetermined goal" or maximum expected cost level. This analysis furnishes an immediate week to week indication of group manpower requirements based on workload.

Variance Cost Ratio

Represents the difference between the "Current Week Total Cost Ratio" and "Goal Total Cost Ratio." The goal appearing at the bottom of the report is engineered to express a reasonable expected target to be achieved. The goal as such may be revised periodically as the activities change or as more control is exercised by supervision.

Equivalent Personnel (Over)/Under Goal

Reflects the equivalent manpower variance from goal based on Column "N" cost value.

PROGRAM SUMMARY

It can be stated that specific benefits realized through application of drafting time standards and reporting are numerous. A few of the more tangible benefits of the program include:

- Improved Cost Estimating Capability
- More Realistic Time Targets for Each Drafting Activity
- Measured Work Performances (Individual and Group)
- Weekly Labor Cost Summaries
- Basis for Planning, Scheduling, and Determining Level of Drafting Backlog
- Continuous Visibility on the Amounts and Sources of Non-productive Time

Additionally, as depicted in Figure 20, example statistics four months after installation of the pilot program reveal a significant improvement in productivity.

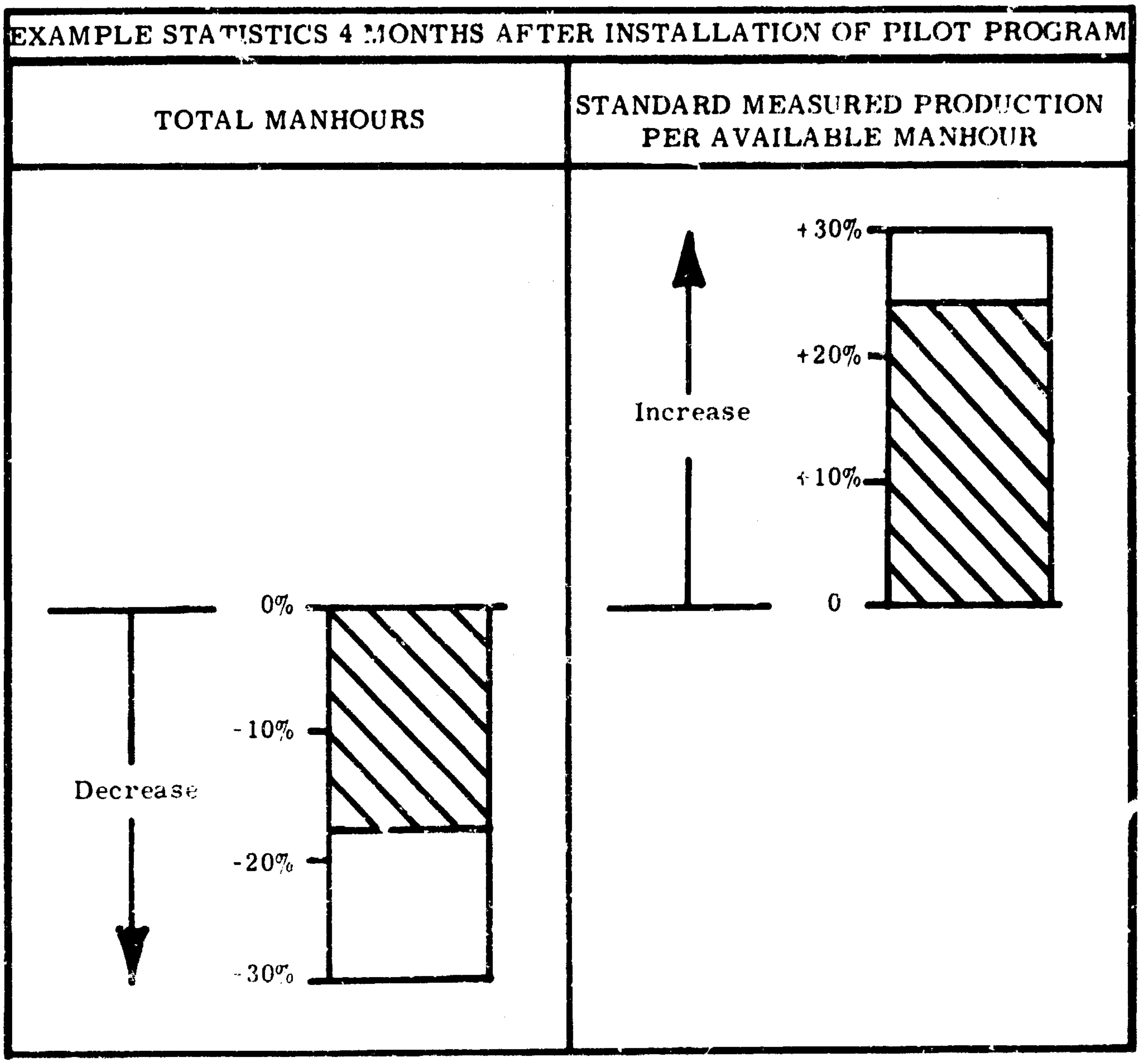


Figure 20.

Far more has been gained from the project, however, than the benefits realized from the initial implementation. In the last several months, Engineering Management at additional operations have officially requested that their drafting functions be included in the Engineered Standards Program. Much of the data already developed has been found to be directly (or with slight modification) applicable at the interested locations. On that basis, the program can be implemented at these locations with a minimum schedule for the development of time standards for unmeasured drawings and layouts.

For any organization wishing to utilize the "work measurement approach in labor cost control," I would suggest that the development and application of time standards and reporting be contingent upon the assignment of a qualified work measurement engineer reporting to the function responsible for developing labor time standards. Program surveillance and standards maintenance capability thus established insures overall integrity of the system with respect to time standards, claiming and reporting. The product of such an arrangement provides the basis for accurate labor cost and performance visibility for the department being measured.

oOo

March 3, 1966

E-2 NATIONAL CONTRACT MANAGEMENT ASSOCIATION
DAYTON, OHIO

TOPIC – RIGHTS IN DATA, PAST, PRESENT AND FUTURE

Denham Scott
Assistant to the President
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Greetings. The first point I wish to make is that I am neither an engineer nor a lawyer. As a member of company management I work very closely with both groups. I started to work in the aircraft industry thirty-nine years ago, when today's exotic Aerospace products existed only in the fertile imaginations of such dreamers as the erstwhile and long dead Jules Verne. Evolution has brought about many changes in practices and attitudes, and no doubt will continue to do so.

Engraved on the birth certificate of the United States are the following words: "Congress shall have the power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." (The Constitution of the United States of America, Article 1, Section 8, paragraph 8.)

The above words from our founding fathers express the philosophy upon which the laws that govern our free enterprise system are founded. The system includes protection by granting title to patents, the common law protection of proprietary rights in trade secrets, and, of course, the copyrights of authors. These systems have been proved to be so dynamic that under them the then-infant nation steadily progressed and, within an amazingly short span, became the richest and most powerful nation in the world. Today it is the main bulwark of the peoples of the free world standing against the serfdoms of communism and socialism. The system of free enterprise has endured the trials of 175 years. It has served us well. We must think long and hard before we abandon it, or even change it.

The vexatious and mischievous "rights in data" problem, with its current unravellable complications, is, to a large extent, an incidental product of the aerospace age. Only a few years ago the government's approach to the aircraft industry was something distinct, and apart. Today that industry has been absorbed into the Aerospace complex, which is a conglomeration of ordnance, rocketry, electronics, exotic fuels, wizardry, and other forms of magic. The household names of the Aerospace industry must now include General Motors, General Electric, Westinghouse, Chrysler, and Ford, along with Douglas, Boeing, Lockheed, and Pratt & Whitney of aircraft fame.

Within the government there were two distinct philosophies of procurement, an ordnance philosophy for the acquisition of guns and munitions, and an aircraft philosophy for the acquisition of aircraft. The advent of the Aerospace industry has brought about a conflicting mixture of requirements, with frequent clashes against the old order of things. The traditional different approaches were not the result of happenstance; there were deep-seated fundamental reasons as to why a different philosophy was adopted for aircraft procurement from that which was traditionally used for shells, guns, torpedoes, etc. Reconciling the "rights in data" problem is smack in the middle of the conflict between the opposing philosophies.

In a nutshell, the civil servants on Uncle Sam's direct payroll designated the ordnance products for the Army and Navy, whereas private stockholders' money paid for the designs of the original aircraft industry. We had then a black and white situation, as exemplified by Class 1 (for government) and Class 2 (for contractor) drawings. In the Aerospace industry of today the moneys are frequently hopelessly mixed. The black and white distinction has become a mixture of every shade of gray. Sorting out the very valuable rights in the know-how or data has become a chaotic task.

Now let us take a look at a little history. The essentials of the story are simply that before the days of aircraft, the United States Department of Defense consisted of the U.S. Army with its ordnance corps and arsenals, and the U.S. Navy with its bureaus and shipyards. These are, of course, the senior services. The Army had its need for guns, firearms, shells, cartridges, explosives, etc. The Navy had its need for different types of warships and their guns, torpedoes, and armament, etc. These things were understandably not to be had on the open market from private industry; therefore, these senior services were founded on the concept that they must design, and in most instances, build their own. The Army arsenals and Navy bureaus employed on Uncle Sam's direct payroll the expert civil service engineers, who of course prepared their drawings on the predecessors of today's Class 1 formats. In the event of war or an exploded need for large production, they took these drawings to industry and contracted for the production.

Obviously, industry had no rights in these drawings. The next stage was reached when during wars and threats of wars the need for armament engineering time became so great that the military or civil service engineers were not available in sufficient numbers; therefore, the defense, or war, department contracted with industry to supply the engineering manpower to assist in the design of weapons for and under the direction and control of the Army or the Navy engineers. Since these procuring services were contracting for and controlling these designs, it was only right that they insisted that they be on government format, title block, part numbers, etc.; in other words, Class 1 drawings. Obviously industry had no rights to these drawings.

The philosophy of, and the concept of, Class 1 drawings is as old as the Army and the Navy are. It became the traditional practice, and we all know that it survives in the Army and Navy today. Originally it was logical, simple, and just, and it still is in its proper applications, but as previously mentioned, the aircraft industry was based upon an entirely different philosophy and today's Aerospace industry is something else again. Evolution has produced a blend that is neither fish nor fowl.

There was, of course, no Air Force when the aeroplane was born, but both the Army and Navy soon became interested. The signal corps of the Army, on April 2, 1908, signed a single page contract with the Wright Brothers to "manufacture for" and deliver to the United States of America one heavier-than-air 'flying machine' in accordance with signal corps specification No. 486.

In this unbelievably simple contract, and even more wonderful specification, the Army did not contract with the Wright Brothers to "design" a flying machine. The contract read, "manufacture and deliver." That crystal clear gem, specification No. 486, in spite of its marvelous brevity said, "Plans received will not be shown to other bidders." It also says, "...The government does not contemplate the exclusive purchase of patent rights for duplicating the flying machine." The philosophy of and the concept of Class 2 drawing is, therefore, at least as old as the first contract for a military aircraft.

Actually, during World War I and the period which followed it, there was a certain amount of backsliding. The Army and the Navy found tradition too much for them and they got back into the design-and-build their own aircraft concept — I am sure most of you know that today's A.S.O. stands on the site of the old naval aircraft factory in Philadelphia — Well, anyway, this did not work out satisfactorily for the military. As you probably know, our boys flew British and French aircraft in World War I because there were none of our own suitable for combat against the Germans. By depriving private industry of the incentive and support of government contracts, the aircraft industry in the United States had become stagnant.

Pretty soon the French, the British, the Italians, and even the demilitarized Germans were trimming the pants off us. and held most of the aviation world records. It took a little longer than it took for Sputnik to jolt us, but at last, in Calvin Coolidge's administration, the Morrow board was set up to hold hearings and investigate why the United States had become a fifth-rate air power. In 1925, the Morrow report was presented and contained the following:

> "Anything that strengthens the industry as a whole, and especially anything that conduces to the strengthening of the design and engineering departments of the companies building aircraft must be considered as a contribution to national defense."

And among its recommendations is the following:

> "Proprietary rights in design must be fully recognized."

That same year, 1925, there was another congressional committee report, known as the Lampert report, from which the following is excerpted:

> "The aviation industry is an essential part of the national defense and must be maintained. The committee finds as following:
>
> 1. That the aviation industry in the United States has dwindled and is dwindling; and that the principal causes of the weaknesses of the industry are as follows: — (among others we find)
>
>   d. Failure to recognize and protect design rights."

The Lampert report included among its recommendations the following:

> "6. That congress authorize the procurement agency to recognize rights in designs of aircraft, engines, and accessories."

Primarily as a result of these investigations and recommendations congress adopted the Army and Navy Procurement Act of July 2, 1926, which specifically recognized the importance of aircraft designs, made provision for design competition, industry's right to just compensation for use of their designs, the right to sue, etc., etc.

Ten years later, in 1935, President Franklin Roosevelt appointed the Federal Aviation Committee. In their report they had this to say:

> "We feel the arguments against any transfer of design from one manufacturer to another to be so strong that they should only be overruled in the most serious cases, as when the originator is already overloaded with work or when the order to be placed is too large and delivery too urgent for the whole responsibility to be left with one company."

In 1948, Senator Brewster submitted a committee report which, speaking of subcontracting said:

> "In such instance, however, contracting officers should recognize that development and design must be controlled by the originating company, and that the originating company must be duly compensated for its design rights and services, in order to maintain essential development incentives."

There is much more that could be said and quoted, but let the foregoing suffice to demonstrate that a new philosophy, that of design competition by industry, and recognition of proprietary rights to these designs and, if you will, the birth of Class 2 drawings for the aircraft industry started over fifty-seven years ago with the very first government contract for a "flying" machine.

Summarizing at this point. Those who were steeped in the Army and Navy tradition of government ownership of designs or, if you will, Class 1 drawing philosophy, caused the government to vacillate for a while, with near disastrous results. The mistake was recognized and thus the junior services, namely the Navy's Bureau of Aeronautics and the then United States Army Air Corps, broke with the tradition and adopted the procurement by the design competition method. This provided the essential development incentives to which industry responded, by rapidly nosing the United States from fifth place to first place.

Thus, the aircraft industry matured into the healthy and powerful instrument which became the most decisive factor in World War II, and is probably the greatest deterrent today to World War III.

These things became possible only because the junior services of the Army Air Corps and the Navy's Bureau of Aeronautics realized that for them and their problems the system of free enterprise by industry in design competition was far superior than that in which the government assumed and tried to exercise a monopoly of all the brains. The free enterprise system, of course, is based on open but fair competition, patent protection, and recognition of proprietary rights in designs and know-how.

Until 1955 the different segments of the aircraft industry, namely the airframe, engine and accessory groups, accepted without question the fact that one of the government contractual requirements would be for a full set of manufacturing drawings. We had no qualms or misgivings because there existed a clear understanding between the contractor and the procuring service that these were needed for various internal military functions, such as repair and overhaul, etc., but would not be used for competitive reprocurement.

The contractual language was a little hazy on the subject, but we lived up to our agreements and they lived up to theirs. For years the ruling specification was MIL-D-5028, and the words "manufacture," "fabrication" or "procurement" did not appear in paragraph 6-1, "intended use" (of data required). This was no oversight, it was by mutual agreement. I was there. Further, most of us placed restrictive proprietary legends on our Class 2 drawings, and these were always accepted without question by the Army, Navy and later the Air Force. In other words, Class 2 drawings meant "contractor" drawings, and implied contractor ownership. Also, each of the services had published their own policy statements, respecting the proprietary rights of their contractors, and we could find no fault with these policies. I have copies of these former Army and Navy and Air Force fine policy statements.

Everything was moonlight and roses until 1955 when the Army had a squabble with a contractor over proprietary rights in data developed in the course of an R&D contract and the Army asked the Honorable Thomas Pike, then Assistant Secretary of Defense for supply and logistics, for an official interpretation of the meaning of the boiler plate language which had been appearing in defense boiler plate for years. The question was pointed to clause IX-112 labeled, "Reproduction and use of technical data," and particularly to the meaning of the last fourteen words as follows: "or to grant any right to reproduce anything else called for by this contract."

This was the hazy language, which had been mutually interpreted as meaning that the government was not acquiring the rights to reproduce the "hardware" (being the anything else) referred to in the sentence. Thus in 1955 Mr. Pike upset the apple cart by officially ruling that this language did not constitute any such agreement, and was in fact meaningless.

Unofficially the United States had drifted into a very real and earnest cold war, and had become deeply involved in a fantastically expensive race for technological supremacy. Times and circumstances had indeed changed; Uncle Sam was spending the taxpayers' money in astronomical sums for gigantic projects. The nuclear and space age was arriving and the Aerospace industry had become a very real fact of the new era.

As custodians of the public purse congress rightfully regards it as its sacred duty to obtain for the government everything that the taxpayers have paid for. Congress was acutely aware of their huge appropriations to the Department of Defense and was determined that the tax dollars which must be spent with industry be disbursed in such an equitable manner as to bring maximum benefits to the broad base of the nation's industrial complex. In particular, congress was determined that small business would get its share. They were properly both suspicious and fearful of possible monopolies operating in restraint of free trade. They were apprehensive and resolved to prevent a few industrial giants from obtaining a concentration of economic power by virtue of their participation as prime contractors.

They wrongly assumed that the government was paying for all the research and development and therefore was entitled to all the resultant know-how. Therefore, aided and abetted by the G.A.O., the pressure was applied on the Pentagon to obtain the rights in the technical data as a matter of course in Department of Defense contracts. In other words, certain very powerful proponents were urging that the age-old ordnance philosophy of government ownership was to be applied to Class 2 drawings.

The fact that the accessory and equipment manufacturers, many of whom were small business, were still privately financing the design and development of their specialties for their customers, the prime contractors, was frequently overlooked, as was also the very basic fundamental fact that American industry is simply not in business to design products for others to build. Water will start flowing uphill before that fact changes.

The net effect of the Pike interpretation was to open the door to a retroactive sweep-in of the millions of drawings which had been submitted in confidence during the years when the old reproduction clause IX-112 with its hazy language was relied on for legal protection. The G.A.O. prodded the Pentagon to betray the confidential aspect.

The fat was in the fire; the members of the old aircraft industry were shocked, but things coasted along about as always, while the aircraft industry hoped that the nightmare would go away.

In 1957 the old reproduction rights clause was replaced by the introduction of the first version of ASPR IX Part 2 dated April 9, 1957. The less said about late 1957 and 1958 the better; the principal trouble lay not so much in the many faults of the document, as in the interpretation, which was universally adopted by the three services. Although this version of ASPR IX Part 2 provided for the recognition of proprietary rights and the acceptance of contractor drawings for limited purposes only, the hard, cold facts of 1958 were that these provisions might just as well not have been included in the document, because by Department of Defense policy, which must have been directed from the top, the unlimited rights clause was bludgeoned into virtually all D.O.D. supply-type contracts. The fat had now really exploded, and screams of anguish could be heard all over. Late in 1958 the Department of Defense finally realized that inventive small business was also being unfairly crucified and attempted to make some amends by the issuance of a revised and somewhat improved version known as the October 15, 1958 Issue of ASPR IX Part 2. Although somewhat improved, it nevertheless was doomed for failure because of certain impractical features.

One major weakness was its definition of proprietary data, which turned the decision on a test as to whether or not the item or part could be reproduced by reverse engineering. Copying by reverse engineering is legal under common law; however, the test in the public domain lies in taking the actual steps of reverse engineering starting with the hardware, whereas the Army, Navy, and Air Force took advantage of their fortuitous possession of the contractors' drawings and asked the question, "Could it be done?" Given the resources of the United States Government, the answer obviously in most cases was in the affirmative. Another serious defect in the 1958 version was the senseless rigarmarole of identifying by marking or circling each and every proprietary element or characteristic on every drawing within a set of drawings. However, the devastating flaw which no doubt had much to do with its ultimate undoing was the so-called "fail safe" clause which said in effect that notwithstanding any specifications or tables to the contrary, and referenced elsewhere in the contract, proprietary data need not be furnished unless specifically negotiated for. The obvious legal solution was to withhold the proprietary elements even though MIL-D-70327, AFPI 71-77, WR-30, WR-12, and a host of other contractual documents called for complete data to be delivered. To withhold it necessitated removing it, therefore perfectly good sets of usable drawings were deliberately emasculated in order to deliver sets to the government which were not suitable for fabrication. Emasculation is a costly operation, but the government insisted on the unlimited rights clause as being applicable to the data to be delivered under the contract. Industry hated the need to emasculate, but very frequently was left with no acceptable alternative.

It is perhaps worth mentioning in passing that the implementation of the 1958 rights in data policy and practices coincided with the introduction as a mandatory requirement for all contracts involving design and hardware to include a requirement for drawings to be prepared in accordance with MIL-D-70327. Therefore, by virtue of a directive dated April 9, 1958, from the Honorable Perkins McGuire, Assistant Secretary of Defense, to the Army, Navy, and Air Force, a requirement for a complete data package was an inevitable requirement in the boiler plate section, whereas strong pressure or virtual ultimatums were used to force the acceptance of the unlimited rights in data clause. It is devoutly hoped that some of the overreaching tactics employed during the 1957 to 1964 period will never be repeated. The cost of the damage done to morale, the widespread bitterness of distrust and disgust between the Department of Defense and its contractors will never be known. Such general frustration is extremely costly, as well as being unpleasant for everybody.

"Rights in Data" is largely a legal problem, therefore the lawyers in the Department of Defense and the individual services, not only got into the act, but dominated the decisions and wrote the rules. It is unfortunate but true that the legal fraternity is too remote from the functionaries way downstream to understand the every day problems of logistics, cataloging, provisioning, inspection, maintenance, manufacturing, overhauling, and evaluating, personnel, etc., etc. As a result, the lofty academic and legalistic language which included the 'fail safe' loophole confused many people, including many members of small business, congress, and the G.A.O.

Congress and G.A.O. kept up the relentless pressure on the D O.D. to acquire packages with unlimited rights so that they could be used for competitive procurement. Seldom, if ever, was any thought given to purchasing the proprietary elements. Creative members of small business, without benefit of legal advice, naively submitted their proprietary information because they did not understand that according to the 'fail safe' clause, it need not be delivered. Usually these drawings were then used to solicit bids from one and all. Naturally the original designer felt that Uncle had gypped him. Industry soon learned that the only safe way was to withhold the proprietary elements and submit the so-called swiss cheese drawings. Industry hated to deliver such phony packages; the Army, Navy, and Air Force hated to get stuck with them; and the G.A.O. accused everybody of being stupid or dishonest. The fact that nobody was happy is a gross understatement.

By 1963 the Department of Defense was ready to declare the 1958 ASPR IX Part 2 as an unworkable document. Industry had been convinced of that since 1958.

Naturally tempers get strained in an atmosphere where distrust, disgust, frustration, and exasperation prevail. Industry was convinced that Uncle was overreaching, whereas Uncle felt that his nephews were withholding a lot of data that had been developed at government expense. Unquestionably some of both was happening.

During the latter part of 1963, Mr. Graeme Bannerman, a most knowledgeable and highly respected veteran of Pentagon Procurement Policy, put together a D.I.A.C. (Defense Industry Advisory Committee) subcommittee for the express purpose of trying once more to solve the rights in data problem. Jim Bannerman carefully chose extremely well qualified experts, including four of the best in industry.

The only possible criticism of the D.I.A.C. subcommittee might be that once again it was heavily weighted towards the legal side of the house.

The D.I.A.C. group worked hard and intelligently and finally a replacement for the "unworkable" 1958 version of ASPR IX Part 2 emerged in May of 1964. It made its appearance first as D.P.C. No. 6, and was later slightly modified as D.P.C. No. 24, and finally, on April 1, 1965, it officially became ASPR IX Part 2 again.

It is still too early to say for certain how many problems it solved or how many new ones will show up as experience is gained. It takes a long time to flush out all the bugs in a new approach.

Most of us in industry are still performing and delivering data under the 1958 version of ASPR IX Part 2. In fact, it will probably be around, particularly at the subcontractor and vendor level, for some years to come. It is perhaps worth mentioning in passing that so-called obsolete specifications sometimes remain lingering in the contractual system for years after they have been replaced. For instance, MIL-D-70327 replaced MIL-D-5028 six years ago, but by virtue of follow-on contracts, and subcontracts, MIL-D-5028 is still an applicable document. Obviously it complicates matters for industry to be contractually committed to perform simultaneously to varying specifications.

The cold war continued, the race for technological supremacy intensified and each year congress fed more and more billions of taxpayers' dollars into the seemingly insatiable machine. Aided and abetted by the G.A.O., several vocal senators and congressmen claimed that the giants were getting fatter, and that the poor downtrodden small businessman was getting scraps or leftovers. They claimed, correctly, that 85% of Defense dollars was awarded by negotiated contracts, and they alleged, wrongly, that these contracts were awarded without competition. They made a big fuss over the fact that the law of the land (the Armed Service Procurement Act of 1947) called for Defense contracts to be normally awarded to the lowest bid after formal advertisement. They harped on the fact that the government was paying for the development, and therefore entitled to the drawings. They argued that even if the big primes must build the major weapons; i.e., Polaris, Titans, Atlas, Gemini, B-70, TFX, etc., that small business could at least build the bits and pieces, if only the big boys' drawings were available for competition. Much heat was generated, including a lot of hot air. The politicians and their handmaiden seemingly could not understand that much of the explanation of the 15% and 85% mystery lies in the fact that it is the inevitable result of the world's spectacular transition from the days of horses, mules, pistols, and swords, to the day of nuclear weapons, electronic computers, Gemini shots into space, and men on the moon.

During the Civil War, and even during World War I, procurement by "formal advertisement" made some sense because it properly fit the majority of cases. However, at the beginning of World War II, the law was quickly suspended in recognition of the fact that there were just too many cases where it would only work towards the benefit of the enemy. We suggest that perhaps in 1966, evolution and advanced technology have brought us to the point where it now fits in only about 15% of our dollar expenditures, and that no amount of lawmaking will alter the fact of evolution. Anyway, a virtual political hue and cry was stirred up by G.A.O. to break down any barriers in the way of using contractors' drawings to obtain competition.

This, then, was the atmosphere in which the D.I.A.C. subcommittee addressed themselves to the task of solving the "rights in data" problem.

It is a matter of opinion as to whether they were right or wrong, but at the outset the committee was convinced that it would not be possible to come up with a mutually satisfactory definition of "proprietary data;" therefore the group deliberately abandoned this fundamental feature of the 1958 approach which was pegged to supplying protection for that which fit within a definition of proprietary data. In my opinion the 1958 concept was betrayed by the unfortunate selection of an unworkable, empty and meaningless definition; however, in 1963 the experts decided to eliminate completely the very word, proprietary, and concentrate on trying to provide protection against use for competitive procurement purposes of data which was developed at private expense. Whether this will prove to be the same old floosie in a new dress, it is perhaps still too soon to say.

The members who worked on the special D.I.A.C. group deserve to be congratulated for their give and take attitude and the spirit of cooperation and harmony that prevailed — most of the time. Their assignment of drafting a procurement regulation which would lead to a fair and equitable solution as to the division of very valuable property rights in data which has been, or will be, generated under conditions involving a mixture of private and government funds would tax a team, with each possessing the wisdom of Solomon.

The 1965 version of ASPR IX Part 2 has, no doubt, been negotiated into many contracts by this time. However, the real tests probably lie in the interpretations and wrangles between the prime contractors and their gadgeteering and creative vendors, and the second and third tier design specialists. Just as the proof of the pudding is said to be in the eating, so in this case the proof of the interpretations will be in what kind of data packages are contracted for and are delivered.

Digressing somewhat from the "rights in data" problem, but continuing to speak of the government's acquisition of contractors', and subcontractor-vendor packages of data, we seem today to be witnessing a bewildering phenomenon in which "data management" is being given unprecendented attention by the Pentagon with declared emphasis on 'cost reduction,' and in which many experts have placed "data management" firmly and conspicuously on the functional charts of the individual armed services, but the net effect of all this concentrated D.O.D. "data management" seems to be more and more disciplines, more and more complicated government controls, and more and more reports, and we suspect for bigger and bulkier packages of technical data — from industry.

Equipment manufacturers whose market includes the many prime contractors must contend not only with the actual flow-down requirements of Department of Defense contracts, but also the tendency of the typical prime contractor to enlarge on these by interpretation. The equipment, or accessory segment of private industry, operates in a keenly competitive field, with stockholders' monies financing much of the research and development effort. The need to feed these privately developed designs and drawings into many semi-public pipelines obviously exposes the proprietor to risks and very understandably brings about wary and sensitive negotiations, and cautious actions.

The recent C-5A competition was an eye opener, and it was encouraging to learn at the Air Force/A.I.A. Data Symposium held in Los Angeles in September 1965, that Robert H. Charles, Assistant Secretary of the Air Force (installations and logistics) was worried.

Speaking to the assemblage about the collosal quantities of data flowing through the pipelines, Mr. Charles had the following to say: "Let me tell you why I am concerned, and the manner in which it relates to the subject of this symposium, that is, Data Management. The C-5A is the first program on which the total package, responsibility-authority, concept has been tried. We want a transport airplane which has only a few basic requirements." .... "Our request for proposal was over 1,500 pages. In reply, the five competitors sent in an aggregate of 240,000 pages, not counting any copies. This is a bookshelf at least 40 feet long, containing 480 volumes, each with 500 pages. Inasmuch as 30 copies of each proposal were required, the total weight was 35 tons. The technical proposals of each of the three airframe competitors averaged nearly 60,000 pages, and the cost proposals averaged nearly 7,000 pages. It took over 400 Air Force peronnel 5 months to read and evaluate the mass of data."

Mr. Charles went on to recognize that obviously it was very expensive for everybody involved to reach the starting post this way, and that perhaps the implementation of the new disciplines of configuration management (375 series) "had wandered a little off its intended course." He further theorized that in view of the fixed price incentive nature of the proposed contract that perhaps it would have been better for the Air Force to clearly specify its requirements in terms of performance, and allow the successful competitor to accomplish his commitment with a minimum of Air Force monitorship.

I am sure many in industry hope that Mr. Charles will not let the matter lie there.

Getting back now to the main theme of "Rights in Data," I believe that most people will agree that the new approach which attempts to resolve the issue on the basis of who paid for the development is fundamentally sound for those cases that are clear cut — black or white, but there is a real question as to its workability in the very large gray area involving hardware which was developed with a mixture of public and private funds. Something additional is needed.

The Air Force and the Navy have fairly recently jointly issued a MIL-STD-789 (A.S.G.) which embodies and implements the thinking and philosophy which follow.

Superior "know-how" is the life blood of competitive industry. It is both priceless and unpricable. However, we are now living in an era in which the government is supporting much of the development of new technology springing from the creative elements of private industry. Uncle Sam quite rightly demands what he has paid for. Unfortunately this "know-how" is almost always a combination of background and foreground knowledge. Industry lays claim to the background but acknowledges Uncle Sam's rights to the foreground. The unravellable nature of the mixture poses a dilemma as to an equitable division of the proprietary rights involved.

Regardless of who finances the research and development work, the end result is often new, up-to-date "know-how" frequently in the usable form of manufacturing drawings, new and novel processes and techniques, etc. This "know-how," or these "trade secrets," represent very valuable property. Exclusive possession of superior "know-how" gives a tremendous competitive advantage to any company operating under our free enterprise system. This system derives its driving power and its undoubted success from the very fact that it is fiercely competitive. Therefore, the matter of ownership, including as it does the right to withhold or restrict the use of this data, becomes a deadly serious matter to the design manufacturer.

Again, regardless of whose dollars financed the research and development work which bore the fruit, there are frequently valuable commercial applications for something that was originally developed to solve a military problem; and, by the same token, there are often military applications for something that has been developed by private industry for the commercial market. Another common variation is when an inventive contractor recognizes or anticipates a government need and assumes the risk of private money to completely develop the item before offering it as a Defense item. If we try to answer the question of who paid for what and, therefore, who should own how much of what, we run into many variations. There is some black and some white, but it is mostly gray of every shade.

In spite of this welter of confusion, certain facts emerge with reasonable clarity: They are as follows:

1. Industry no longer can claim right and title to everything.

2. The government cannot claim the right and title to everything.

3. The property at stake is very valuable; therefore the inherent American tradition for fair play demands a prompt solution that is fair and equitable to both parties.

4. There are black (100% government financed) and white (100% privately financed) areas, and these can be and should be sorted out and easily resolved. "Render unto Caesar. . ." etc.

5. The gray areas represent the big problem, and if injustices are to be avoided, they must be negotiated on a case by case basis at the time of the procurement of the data. These negotiations should be held directly between the two parties involved: namely, the government and the designer, be he a contractor or a vendor to a contractor. The present attempt to solve them with a broad-brush treatment has proved to be impractical and inequitable.

6. There must be no compromise with safety.

7. In some areas there can be no compromise with reliability in its new special sense.

8. There is not enough money in the United States Treasury to begin to pay for all of the privately developed "know-how" of the Defense and Space Industry.

9. The government cannot justify its demand for either complete data or unlimited rights in many of the cases in which they are now seeking both.

10. A contractor's good reputation is an invaluable asset that is closely associated with the performance of the products which bear his

nameplates. Such contractors can be seriously and unjustly injured, if unauthorized or bogus parts are permitted to contaminate the supply system. This issue involves aspects of safety, reliability and morality.

Notwithstanding opinions to the contrary, or MIL-D-1000 and MIL-STD-100 and their predecessors or successors, it is not always possible for a design manufacturer to transmit all of his know-how by any paper medium. There are vitally important shop practices, techniques and trade secrets which simply cannot be depicted on a drawing or completely explained in writing.

During World War II and the Korean fracas, when the national emergency compelled the establishment of multiple sources for high priority key items, for instance A-20's, B-17's and B-47's, or when Pratt & Whitney Aircrft engires were built by Ford, it was necessary to set up very real and expensive technical assistance programs, including the interchange of master tooling, etc. No amount of wishful thinking or sincerity of purpose can alter certain facts of life.

Admittedly the solution to the "rights in data" riddle would t... the wisdom of Solomon, but there does appear to be a practical road to compromise. The Air Force's logistic command has adopted it and dubbed it "competition with confidence." It recognizes that worthwhile "pay dirt" for both parties lies in the many thousands bits and pieces which will be procured as spare parts. These are screened against a realistic formula of "criticality." The original design manufacturer gets the repeat business on his own critical items. The balance are mutually agreed to be suitable for solicitation of competition. This seems to be both fair and practical.

Solomon's proposal to divide the baby led to an all or nothing decision, but it looks like with MIL-STD-789 (A.S.G.) and "competition with confidence" the Air Force Logistics Command, and the Navy's Bureau of Weapons have outdone him by finding a way to divide the indivisible. Of course, the spare part problem is only part of the rights in data problem, albeit the thorniest part, and admittedly MIL-STD-789 is only a partial solution to that part, nevertheless it is encouraging to know that some progress is being made. The ramifications of "rights" in data packages or individual drawings which evolved from efforts which were funded by a mixture of private capital and taxpayers dollars go so deep, as to defy a completely satisfactory human solution.

Today, with mutual respect and recognition, we can and are finding ways to iron out the worst of the inequities.

As for the future — the thorny rights in data problem is here to stay. It can and will only be solved on a case by case basis with each party understanding and giving recognition to the just claims of the other. Thank you.

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GRAPHIC TRENDS IN ENGINEERING EDUCATION

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Many of you as you glanced at your program have noticed that your next speaker was a university professor and probably have asked yourselves, "What is a professor doing in our midst? What has he to offer us?" Some of you younger men, recalling your college days and your academic miseries, would rather have nothing more to do with any professor.

Frankly, I do feel rather ill at ease in this gathering of "dollars and cents" men--and from the talks I have already heard I sense the serious intent of your meeting. You are here to exchange ideas, to improve yourselves, and to take back to your respective companies the latest ideas on data documentation, and its applications to the various governmental contracts your companies may hold. Your seriousness of purpose is further reflected in the lack of levity in all of the talks already presented. I had hoped to add a new joke or two to the few weary academic ones that I know.

My presence before you, therefore, may be considered in the nature of a change of pace. Indirectly, I deal in dollars and cents in that I am associated with a product that affects the very work you are doing in manpower--educated, trained and intelligent manpower. Your companies depend on the raw material that professors like me the world over work to produce. One facet of this technological training is in the area of design and graphical communication. My mission, therefore, is to give you an insight into the current status of this training. I will also add a few personal observations on today's trends in Graphics in Engineering Education and in other areas, and show how they affect today's engineering graduate.

A revolution in scientific and engineering education occurred when Russia successfully launched its first Sputnik. It jarred our educators into the realization that we were woefully behind in our technological and scientific goals and educational objectives. Accordingly, a "Report on Evaluation of Engineering Education" was released by the American Society for Engineering Education.

The study for this report was conducted between 1952 and 1955. It became the engineering educators' bible and set the course of engineering education for the next decade. It became known as the "Grinter" Report, named after the Chairman of the Committee that made the study. It gave the engineering schools a choice of two directions. They could bifurcate and proceed along professional and scientific paths, or develop a scientific oriented curricula, based on a strong foundation of mathematics and the physical and engineering sciences. The latter path was chosen and scientific emphasis was placed on all engineering curricula. The tendency grew to down-grade or eliminate "skill" or "applicatory" courses, and to make room for new material involving from our expanding scientific and technological growth. Engineering Drawing, or "Graphics," as it is popularly called, and many other heretofore traditionally solid engineering courses fell to the time axe.

Industry is well aware of the sharp, theoretically and research-minded engineering graduates it is recruiting today. To fit them into its production programs and to make them productive as soon as practicable it must conduct extensive and expensive programs of its own.

When this change-over from professionalsim to scholasticism in engineering education was taking place industry barely raised its voice of protest above a whisper. In direct contrast to the opinions of the academic world its pleas were almost inaudible. Industry today is reaping the results of this lack of organized protest. It finds the engineering graduate strong in scholarly capacity and attainment, and weak in professional competence.

When in 1953 the Professional Scientific curricula approach to engineering was adopted, and the Professional General rejected, an engineering gap began to widen. Like a chameleon changing colors graphics endured as a basic study only by changing its traditional form, proliferating its name, and shifting its emphasis. In many schools severe reduction in time has caused it to become a mere academic gesture with its graphics faculty decimated by transfer to other areas, by dismissal, by retirement, or by promotion to positions in the Office of the Dean.

Gradually, however, as the gap continued to widen, there began to emerge a widespread feeling of industrial protest. This rising ground swell of opinion has finally brought the conviction that the Scientific Oriented educational program is not relevant to the needs of many technical industries--industries who previously found their sales, maintenance, operation, construction, manufacturing and management personnel among engineering graduates. Graduates were just not being trained or educated to go into these fields.

In 1961, the Engineering Council for Professional Development gave tacit recognition to the fact that, from the extreme of the technician to the research scientist, there existed many gradations of essential work that required an appropriate pattern of professional development to fulfill the total engineering team effort, and that"...adequate recognition of the total pattern of the engineering team effort in maintaining standards of professional development may well be one of the significant steps required in the near future." Accordingly, the American Society for Engineering Education directed the ECPD to make a new study of Engineering Education, and to project guidelines and objectives for the future. In 1965 The Preliminary Report of the Goals Committee was released and is now under debate.

The Graphics Division of the ASEE and its individual members have all along tried to shore up this widening gap in their area of pre-engineering instruction. It is doubtful if any area of instruction has been as valiant in its resourcefulness to maintain course coverage against the pressures that were buffeting it about from every source, and at a time when its field was growing more complex with newer applications uncovered by advances in technology.

Graphics' voice in curricula structuring has always been minimal. There are isolated cases of graphics instructors who, by the virtue of passing years and seniority in tenure, have been granted positions of affluence as Committee Chairman, or as Assistant Deans. Their degree of enthusiasm and their personal convictions relative to graphics may be reflected in small measure in the status of graphics offerings in their schools.

But with no voice in curriculum planning there was no effective opposition when the Grinter Report pushed graphics to the bottom of the time ladder and to a doubtful position as a significant engineering subject. Academic administrators, concerned with new courses and increasing credit hours for graduation, judged graphics by their own experiences of twenty and thirty years ago. They remembered the chisel pointed pencil, the hours of lettering, the ink-smeared plates and the neatly formed arrowheads. This definition of graphics naturally placed it low on the scale of importance as an engineering subject within the framework of a scientific oriented curricula and the squeeze was on.

Let us assume that The Preliminary Report of the Goals of Engineering Education Report has given the future of graphics a nod of approval.

The time, therefore, is at hand when the Graphics Division of the ASEE ought to speak in clear words and simple language what it stands for, what it can do and what it is prepared to do for its role in engineering education, if permitted to do so. The Goals Report has provided broad guidelines and has suggested analysis, design and engineering motivation as the avenues graphical communication should follow. If ever before an opportunity to do a selling job presented itself for the re-establishment of graphics as an important and basic course in the engineering core of subjects, it lies within the months ahead. The Goals Committee report, even when amended in final form, will have--as the Grinter Report did--a significant impact on the future of Engineering Education. Colleges and Universities will be evaluating and reorganizing their curricula to phase in with its education projections. With the recognition that modern technology has a wide spectrum of activity and has a preponderant need for professional rather than scholarly trained personnel, bifurcation and multifurcation of engineering degrees will be initiated. Graphics' role will be in the basic subjects that will form the engineering core, along with mathematics, physics, chemistry, English, history and the humanities. How much time will be allowed; its importance to degree granting departments the amount of coverage and what should be covered in graphics are contingent on the educational and regional objectives of individual institutions. Where one institution enrolls students who never before held a T-square in their hands and must begin with courses in basic fundamentals; another may have selective enrollment and can indulge in advanced courses in graphics or teach one, or several courses that have been developed as valuable graphics by-products during the past few years. The graphics sequence, therefore, will vary from schools to school and coverage will be influenced by departmental demands, time limitations, and faculty capabilities its emphasis can be pictorial, quantitative, symbolic, mathematical or graphical. No one individual school can say that its presentation is the answer to another's. Our technological advances have so expanded that graphical knowledge, like all knowledge, has newer and broader horizons The fact that in recent years graphics has been put to the test has worked in its favor The chaff in course content has been eliminated and the entire field of graphical communication has acquired vigor and substance and scope in coverage. Of importance should be the realization that the field of graphical communication has expanded into a sequence of graphics courses rather than one. The sequence starts with basic Engineering Drawing and goes an through Computer Graphics and beyond to sophisticated industrial applications.

Recognition as a basic engineering subject, and adequate time in which to teach graphics, are of immediate concern in importance, and calls for immediate action. Subject coverage and the extent of coverage are contingent on both. Lacking these the graphics teacher can only do the best he can, in the time he has and not lose his dedication in his beliefs.

Graphics, therefore, is a patient and its faint heartbeat has been quickened by helpful references to its future status in the Goals Report. These statements, however, are not the miracle drugs that will restore the patient to overnight health. Diagnosis of the patient's many ailments and the prescription for proper medication is the challenge that lies before the Division of Graphics and its individual members. Graphics has been a wheelchair patient too long and may continue to remain as such unless there is an immediate call for a doctor in the house--? And you, gentlemen, as representatives of industry can assist this doctor. As consumers of our raw product--the engineering graduate--you have a right to raise your voices in protest, if you are dissatisfied with the finish of this product. Your protest written on the letterhead of your company can be very effective, and certainly will create more than casual interest.

E-4 A REPORT ON THE DOD DATA MANAGEMENT COURSE

Lt. Colonel Sydnor J. Borden

Head Department of Logistic Plans

School of Logistics

Air Force Institute of Technology

I appreciate the opportunity to be here this morning to tell you about our Department of Defense Training Course for Data Managers and to publicly thank the many of you who have contributed so heavily toward its success.

In the next few minutes, I will review briefly the events leading up to the establishment of the course.

I will describe the course curriculum as it is now; try to identify our students, and report the latest developments toward introducing the course to industry - in that order.

Very early in the sixties, the number and sources of complaints about the inadequacies of data began to intensify. I can't point with certainty to any single isolated reason for this movement, but a case could probably be made for the PRESS TO COMPETE. Pressures to compete were building up. Service personnel in increasing numbers were complaining that they could not compete because the data was inadequate:

It wasn't there;

It was not complete;

It wasn't ours.

But the pressure to compete continued. The explanation for failure to compete -- that adequate data was not available -- increased the intensity of the spotlight that was already focused on data.

Eventually and inevitably, the subject of the cost of this data also entered the picture. The estimates and guess-timates of data cost were so shockingly large that more people became concerned. And when questions of cost could not be answered easily, the numbers of those pressing for better management rose rapidly.

And then our industry friends joined the fray. They assured us that we were:

Buying data we did not need;

Were buying in expensive formats;

Buying excessive numbers of copies;

and, in general,

Were using less than fully-enlightened management in our data acquisition operations.

There were other events leading up to the establishment of a data course. A few might be mentioned without implying any cause-effect relationship.

Representative Harry P. Sheppard of California wrote to the Secretary of Defense in April of 1962 quoting "Barrons" to the effect that the Defense Department Procurement of Technical Manuals was a 2 to 3 billion dollar annual business which was not being adequately managed. Soon after this date, the Air Force initiated several unilateral actions.

In June of 1962, the Air Force Industry Conference, at Monterey, California, identified many specific problems and areas for managerial attention by Air Force and industry leaders. Many of these problem areas concerned data.

The Air Force convened a conference at the Arnold Engineering Development Center at Tullahoma, Tennessee, in July of 1962, to plan a course of action to deal with identified data problems.

Early the following spring - in March of 1963 - the Department of Defense published a DOD instruction which established the DOD technical Logistics Data and Information Program, under the Assistant Secretary of Defense (I & L), then Mr. Thomas Morris.

A Technical Logistics Data and Information Committee (The TLDIC) with Mr. John Riordan as Chairman, was established to accomplish the objective of this program.

Among the problems that Mr. Riordan recognized was the immediate need to educate people in this new philosophy AND ITS DEVELOPING PROCEDURES.

Subcommittee Number 7, Chaired by Lieutenant Colonel Bill Shephard, was formed to develop a proposed course curriculum for a Defense Data Managers course. Colonel Shephard signed the Subcommittee Report on 27 November 1963. However, before staffing through the Military Departments could be completed, the Office of Technical Data and Standardization Policy was established in the Office of the Assistant Secretary of Defense (Installations and Logistics) on 12 June 1964, and the then Brigadier General Stanwix-Hay named to head it. This new office inherited the DOD Policy Guidance for Data - including the proposed training course. Colonel Shephard was ordered to General Stanwix-Hay's Office, and, of course, retained the responsibility for the establishment of the training course which he had recommended.

To wrap up the story quickly, Army, Navy, Air Force, and DSA Personnel were eventually assigned to the School of Logistics, Air Force Institute of Technology, and in August of 1965, the first offering was launched.

The plan for course development recognized that:

> There was no textbook to follow,
>
> No suitable course to use as a guide,
>
> and, no over-all specialists available -
>
> only specialists within relatively narrow limits.

To aid in overcoming these handicaps, the first two classes were made up of students handpicked by the Departmental Representatives to the Committee on Technical Data and Standardization Policy. Those selected were the most highly-qualified people from each field of specialization within the area encompassed by the new field of Data Management. They were asked to constructively criticize the course, to look for errors of omission, as well as commission. They did their job very well.

The course itself - the curriculum, the source of visiting instructors, and the instructional methods have changed during the first eight months of operation. Except for changes which may be recommended by the DOD as a result of an evaluation now in progress, we expect only evolutionary modifications from now on.

CHART 1

However, my first chart shows how the instructional methods have changed. The numbers in the first column are classroom hours spent on the respective activities during the first offering. The third column figures are hours for our fifth and most recent offering, and the middle, or delta column shows the incremental change.

The only item on this chart which I feel needs a comment is recapitulation.

This 30 minute session each morning has proven to be extremely valuable for insuring continuity between subjects and between speakers with differing backgrounds, and for explaining how the day's subjects fit into the over-all data program.

This same format will be used by all charts. I have reproductions in the lobby for those who are interested.

CHART 2

The next chart is the first of seven blocks of instruction making up the course. This chart is administrative only; it contains no substantive course material.

CHART 3

Block II introduces the course by explaining the background which resulted in the decision to manage data as a separate functional area. The development of this need to manage data functionally leads, logically, to the Department of Defense Directives, with their policy guidance, organization at Governmental and DOD level, and philosophy of operation of the management system.

The discussion of the role played by the Data Manager starts as a philosophical approach to his position and function in the system, and progresses to a discussion of the responsibilities of the job at different levels.

As you would assume from its placement in this block, "Functions Related to Data Management" is also a higher-level presentation. It treats the development of Data Management and the elements making up this area from a different approach. We have been most fortunate in being able to get Mr. John Riordan of the Office of the Assistant Secretary of Defense to present this subject for us in 4 of the 5 offerings to date.

Block III is built around the purposes for which data is acquired. We want the student to understand that all data is acquired to meet a real need -- that not even copies should be delivered unless the receipient has a real and defensible need for them. Since present policy places a man in the position of managing the flow of all data, we want this man to be familiar with the uses to which this data is put, so that he can intelligently question the need for specific items for specific uses or to suggest data when needed items are obviously missing.

This block is introduced with a presentation we call "Sources of Contractor Generated Data." It is a chronological development of a fictitious firm, starting with a one-man operation, and showing the growth and expansion of the firm, until it is able to bid on and win significant Government contracts. This little bit of fiction is designed to show, primarily, the development and use of data by the enterprise for its own needs, as a background against which we can better explain how this SAME DATA is acquired by the Government to fill a wide variety of needs.

We progress from this background to discussions of the more important uses the many individuals and agencies have for this data. We discuss, for example, the kind of data needed for procurement, and, also, the kinds of procurement possible with the kinds of data we have. Tech manuals, configuration, management, maintainability and reliability, and PERT are explained in just enough depth to give the student an understanding of the functions so that he might be better able to understand and evaluate needs for specific items of data.

The scientific and technical information (STINFO) area is explained because of the great and increasing importance being placed on this data, and because of the close interrelationship between scientific data and technical data. We believe it is essential that the data management and the STINFO people know each other and each other's business, if an even acceptable job is to be done by either.

We have used the term "Procurement Considerations" to cover a discussion of the need for and the use of data in provisioning, standardization, and federal supply cataloging functions. These are closely allied functions and are well-suited to this homogeneous treatment.

CHART 5

Block IV is legal and financial. "Rights in Data" is covered by a Staff Attorney. We try to make clear to the students the intent of the ASPR in the division of rights in design data between the Government and industry.

Areas in which the Government rightfully has unlimited rights are contrasted with areas in which the Government may claim only limited rights. The great areas of grey are discussed in the light of the Government's need for and use of the data.

We cover the various kinds of contract, emphasizing advantages and disadvantages and Government policies guiding the use of each.

The next item is a very short lecture -- only half an hour -- but it should be interesting out of proportion to its length. It was born after a theft of microfilmed drawings—which were recovered almost immediately. During the investigation and subsequent hearing, the responsibility of the Government and its agents to protect he property of contractors was brought home to one of our people. He now feels duty-bound to carry the message to others, and, as a result, our students "get the message" from a convert -- and a convert brings the most fervent kind of message.

We also cover pricing and price estimates, the DOD cost reduction program and the Bureau of the Budget Reports Clearance procedures.

CHART 6

Block V, Procurement, starts with a session we call "Contract Administration." In one session, we survey the area of Contract Administration, starting with the Pre-1963 way of doing business, and progressing through "project 60" days to the present. The functions of PCOs and ACOs, and their relationship with the data manager are explained and contrasted, and the philosophy and eventual placement of responsibilities under "project 60" are discussed.

We discuss procurement method coding by the contractor, sometimes called competition with confidence, and now covered by the Navy/Air Force MIL-STD-789. This is of special interest because the procurement method agreed upon determines the kind of reprocurement data needed and contains at least an implicit guarantee of rights to the data to SUPPORT the kind of procurement recommended.

Quality assurance is an integral part of Contract Administration, and is a responsibility of both Contract Administration and the Data Manager. IT is of special interest because quality assurance covering the data area AS A UNIFIED WHOLE has been generally neglected.

The quality audit of engineering drawings is treated separately; we give a brief but detailed treatment of the inspection and acceptance of drawings, with emphasis on what to look for.

Specification management is included to insure student understanding of the use of specifications in the acquisition of data. We cover types, content, and function of specifications, and their relation to the Form-9 type of authorized data lists.

Use of MIL-D-1000 and MIL-STD-100 are discussed and compared with prior methods of specifying data. And we discuss deferred ordering of data both under the Lockheed Test now known as Seed and under ASPR 9-203(e).

CHART 7

Block VI is relatively homogeneous. It covers storage, retrieval, and distribution of data, and various systems for accomplishing this purpose -- manual systems, as well as some of the more sophisticated ones, are described, discussed, and shown.

To achieve a satisfactory and common level of knowledge among the students, we describe the operation of a computer in elementary terms. This description covers theory of operation, input and output equipments, an explanation of programming, and ways in which the computer might be of use to the Data Manager.

Various possible and actual retrieval systems are described, and some are shown. The Air Force Data Depository, using aperture cards to store drawings, is located at Wright-Patterson and is convenient for a tour. To contrast with this operation and furnish a little perspective, we have been able to present an industrial application which produces sophisticated results without requiring unduly sophisticated equipment.

A glimpse into the future has been furnished by representatives from industry, with explanations of computer-aided design and documentation.

CHART 8

Our Block VII is concerned with the Data Management System itself and the implementation of the system by the departments. The Military Departments and the DSA are given a day to present their interpretation and implementation of the Department of Defense-Directed Data Management Program. The first half-day is used to describe the system which the service has designed to meet the DOD requirements. The second half-day is used to describe the actual implementation of this system. In this way, we hope to be able to contrast the differing approaches and techniques and generate healthy discussions on the relative merits of each.

A presentation by an individual selected from one of your Defense Industry Associations furnishes a change of pace by describing the function which you perform in the scheme of things, and how you go about it. We have different people from various companies scheduled a year in advance. The system is working beautifully. We get the best speakers there are; scheduling is no problem; and we hope it does not become burdensome to you.

After YOUR presentation, we go back to the Management System to see how the job is done by an agency which has had the benefit of the DOD experience and the freedom to modify the directives as it desired. The agency, of course, is NASA. The NASA people give the class an excellent presentation of their Apollo Data Management System. It is a good system, and it serves to broaden the perspective of our DOD students, and, we hope, to make them think.

Near course end, and the last item in my block of instruction, is that great question mark, the DOD Air Development Laboratory. Someone from the Office of Technical Data and Standardization Policy comes down to give the students the latest progress report on that knotty little problem and tell them which of the service systems seems to be getting the nod at the moment.

I promised to tell you who our students have been and where you will find them. This is a little awkward because of the great number of job titles involved. I think we can overcome this handicap, to a degree, however, by reading an actual listing of the job titles taken from a class roster.

The following list was taken from our files covering the fourth offering of the course. It should give you some idea of who the students are.

Technical Publications Editor

Supervisory Management Analyst

Engineering Technician

Mathematician

Supervisor, Automotive Design Engineer

Data Management Specialist

Management Analyst

Automatic Data Processing System Project Officer

Supervisory Management Analyst

Management Analyst

Supply Specialist-Procurement and Standardization

Electronic Engineer

Supervisory Supply Standardization Officer

Cataloging Staff Assistant

Manual Management Department Supply Officer

Deputy Comptroller for Data Processing

Supervisory Engineering Technician

The grade spread of these people is a good deal easier to talk about. It goes from Captain through Lieutenant Colonel and from GS-9 through GS-15 - the median civil service grade has been 12 & 1/2.

Since it IS very difficult to describe the students and show exactly where they sit, I have brought copies of the course description and criteria for attendance. I think they will help you in determining who, in the Department of Defense, is coming to the course. You will find a supply of these course descriptions on the table in the lobby.

Two questions frequently asked by representatives from industry concern (1) Instructional Material and (2) Attendance in the Course. I have left a set of our lesson plans and the supporting bibliography with your secretary. I understand that he can reproduce and distribute copies. Concerning attendance, provisions have been made to permit attendance at the Defense Data Management Course of one industry student for each offering.

The only ground rule that the school has, is that attendance will be at no cost to the Government. We charge nothing, but neither can we pay students' expenses.

Arrangements incident to the selection of industry personnel to attend the course will be handled by the Office of Technical Data and Standardization Policy.

I want to thank you again for the privilege of coming down to your meeting to present this propaganda for our Defense Data Management Course.

E-5

INFORMATION ON NEW PROCEDURES BEING TRIED OR TO BE INSTITUTED

Mr. Paul R. Durr

Chief, Data Documentation

Directorate of Supply

Headquarters Air Force Logistics Command

To give a report on what's going on in the Air Force I don't see much need to repeat what has already been said up here today. The reports that Mr. Borden gave, the information that Mr. Parker gave, these are the same things that we are doing in the Air Force, and I might just add one thing. I mentioned Wednesday that we had removed our tabulating card requirements from the data acquisition documents, and we are performing that job in-house now, and this is in relation to all of our aperture cards of the different kinds and formats that we have had since the beginning of this, converting these to a single kind format. We're doing this for obvious reasons plus getting ready for computerization of our entire assets. Once we have accomplished this we hope then to put requirements back in our acquisition documents to buy completed products from industry and particularly from those contractors that are in that business. So with that I think that is about all I need to add to what's already been said.

E-6 OPERATION OF MICROFILM SYSTEM

Mr. Parker H. Daggett, Jr.

Assistant Head Engineering

Data Management Department

Naval Air Technical Service Facility

We at Natch -- are in the process of reexamining what we're doing with microfilm to assure that what we have done is correct. We're comparing fiscal 1966 with fiscal 1964. The reason for 1964, that is the last year in which we operated a basically dual system, paper and microfilm. In our operation we receive and inspect the drawings delivered to us in microfilm form by industry. We duplicate the aperture cards and automatically distribute them to maintenance activities throughout the naval establishment, and on a day to day basis, supply individual demands. For this fiscal year, using the actual total expenses incurred through March 31, we find that our cost for the year will be approximately $800,000. As compared to 1964, this is roughly 3% more. Interestingly enough, however, we will produce something more than twice as many images or drawings for this $800,000, as we did in 1964. Now how does this come about? Well, in the first place, in 1964 in January, 60% of our activity was in aperture cards, and 40% in paper. In 1966, January, more than 95% was in aperture cards and less than 5% in paper. And such paper activity as did occur was being converted automatically into microfilm. As a result of this change to aperture cards, we find that our line item output per man hour has increased by 40%. We also find that our costs have been reduced or held in line because the cost of aperture cards has been cut more than in half. These are aperture cards and copy cards. Now, this is fine, but we must appraise how well this has satisfied the requirements in our using activities. In the first quarter of fiscal 1966 in our (Severnd Major Using Activities), we had them, over a period of 3 months, perform a special inspection of 10% of all the microfilm which they pulled from their files to use. After an analysis, we found that, of all the film that they pulled from their files, just slightly more than a half of 1% was not usable. There was another substantial portion, about 2%, which was still usable but had errors, technical errors in the identification of certain information on the top of the card. In the matter of bid sets we have gone fully into aperture cards for bid sets. This year we will produce a million and a half cards for bid sets. There are no bid sets that we prepare any longer that are paper. Our principal user of these is the aviation supply office. One important factor is - can the prospective bidders use them? They are using them. The rate of error is not calculated. All errors or complaints received from any industry or any company are channelled to the legal council of the aviation supply office. They tell me that they have less than twelve complaints per year. This is very fine performance, we consider. In addition to the quality of these images that are being supplied in the bid sets it is interesting to note that the base for bidding has been expanded greatly. In 1964, the last year of the combination system, the aviation supply office got a total of 300, 000 drawings from us for bid sets. This year the number of drawings equated to the million and a half aperture cards will be slightly more than 4 times the number of drawings previously supplied. We are satisfied that the aperture card system has produced what we said it would in the beginning.

E-7 STATUS OF THE DEPARTMENT OF DEFENSE ENGINEERING DATA MICRO-REPRODUCTION SYSTEM

Mr. Frank R. Borden

Engineering Data Microreproduction
Systems Coordinator

U.S. Army Electronics Command

A. Recently, copies of new and revised EDMS specifications and standards were forwarded to various Industry Associations and DOD activities for coordination and comments. During an EDMS meeting held on 28 March through 1 April 1966, all comments received from this coordination were reviewed and discussed by the EDMS military activity representatives. The consolidation of these comments resulted in the following actions to be accomplished within the EDMS program:

1. Prepare a "General" type military specification which would cover all standard or general requirements and definitions applicable to the preparation of 16 mm and 35 mm microfilm; 105 mm and microfiche film, aperture cards, copy cards and tabulating cards.

2. Prepare "Detail" type specifications for each individual product developed under and for the EDMS program.

B. The following documents are in preparation in accordance with the "General-Detail" type specification approach and when released will constitute the specifications and standards to be used in the EDMS program.

1. Proposed MIL-SPEC on Microfilming and Photographing of Engineering/Technical Data and Related Documents: PCAM Card Preparation, Engineering Data Micro-Reproduction System, General Requirements For, Preparation Of.

a. The Preparing Activity (Air Force - 26) for this specification intends to have a draft prepared by approximately 29 April 1966. This draft will be forwarded to the EDMS Custodians for coordination and comment. Following this coordination, a revised draft will be prepared for final coordination and approval.

b. This specification will contain:

(1) A listing of all applicable EDMS detail specifications.

(2) All "General" requirements covering microfilm, film and PCAM Cards.

(3) All "General" Quality Assurance Provisions covering the inspection of microfilm, film and PCAM Cards.

(4) All definitions for various words and phases applicable to the EDMS program.

2. Revision of Specification MIL-M-9868, Microfilming of Engineering Documents, 35 mm, Requirements For.

a. The Preparing Activity (Air Force - 85) is now preparing the final draft of MIL-M-9868C. This draft will be forwarded to the EDMS Custodians for final coordination on approximately 23 May 1966.

b. MIL-M-9868C will now contain only the detail requirements applicable to the preparation of 35 mm roll microfilm.

3. Proposed Revision (Amendment) of Specification MIL-C-9877, Cards, Aperture.

a. This revision will cover the deletion of all "General Requirements" and "Definitions" contained in MIL-C-9877. The Preparing Activity (EL) for this specification has indicated that this amendment will be ready for final coordination by approximately 23 May 1966.

b. This specification will not contain only the detail requirements applicable to the preparation of aperture cards.

4. Proposed revision (Amendment) of Specification MIL-P-9879, Photographing of Construction/Architectural Drawings, Maps and Related Documents, 105 mm; Requirements For.

a. This revision will cover the deletion of all "General Requirements" and "Definitions" contained in MIL-P-9879. This specification will now contain only the detail requirements applicable to the preparation of 105 mm film.

5. Proposed revision (Amendment) of Specification MIL-C-9949, Cards, Copy.

a. This revision will cover the deletion of all "General Requirements" and "Definitions" contained in MIL-C-9949. The preparing Activity (EL) for this specification has indicated that this amendment will be ready for final coordination by approximately 23 May 1966.

b. MIL-C-9949 will now contain only the detail requirements applicable to the preparation of copy cards.

6. Proposed MIL-SPEC on Microfilming of Engineering Documents, 16mm, Requirements For.

a. The preparing activity (Army Missile Command) has coordinated the first draft of this specification with applicable DOD activities and is now revising the draft for future coordination. This coordination will be accomplished by approximately 30 May 1966.

b. This proposed specification will contain only the detail requirements applicable to the preparation of 16mm roll microfilm for both reel or cartridge use.

7. Proposed MIL-SPEC on Microfiche; For Engineering/Technical Data, Reports, Studies and Related Data, Requirements For.

a. Proposed MIL-M-38748 has been coordinated with all applicable Government/Industry activities. The final draft of this specification has been prepared and forwarded to the EDMS Custodians for final coordination.

b. This specification will contain the detail requirements applicable to the preparation of microfiche.

8. Revision of Standard MIL-STD-804A, Formats and Coding of Aperture, Copy and Tabulating.

a. All Government/Industry comments received on this standard were reviewed and discussed at the 28 March - 1 April 1966 EDMS meeting. Proposed MIL-STD-804B is now being prepared by the Army Electronics Command and will be ready for final DOD coordination with the EDMS Custodians on approximately 23 May 1966.

b. MIL-STD-804B will contain only the detail format and coding requirements for aperture, copy and tabulating cards.

c. The final coordination, approval and release date, for the new and revised EDMS specifications and standards, is tentatively set for approximately 1 August 1966.

22 March 1966

E-8

TECHNICAL STUDY PROJECT ON USE OF DOCUMENT LINE DENSITY

Given By Frank Borden

(4th paper on panel)

In February of this year, the EDMS Area Manager established Project Number EDMS-0031, Technical Analysis Study to Investigate Line Density Equipment, Methods, and Procedures. The Army Electronics Command was named preparing activity, with the Bureau of Naval Weapons, the Defense Supply Agency, and the Air Force Logistics Command as departmental custodians.

The scope of the technical study includes the investigation of equipment, methods, and procedures for using document line density, and contrast between document line density and document background density, as controlling characteristics for quality and reproducibility of microfilm (both 35 mm and 16 mm) and microfiche in place of the present control characteristic (document background density). It also includes the development of Department of Defense standards for line density and contrast to replace the present standard based only on background density.

Much of the investigation will be made using the "SCANALUME" Line Density Scanning Exposure Control Unit installed last month on one of our 35 mm planetary microfilm cameras. The "SCANALUME" unit was described in detail by Ballard Jamieson in his paper "New Techniques for Microfilm Exposure Control" presented to the 1962 Convention of the National Microfilm Association.

The use of line density instead of background density as a control characteristic for microfilm has been advocated for a number of years, and several excellent papers have been presented on this subject. I will not repeat the arguments in favor of the use of line density today.

At present, our investigation has not really started. We are familiarizing our operators with the operation of the unit, and are running background density calibrations of the unit, using the regular camera photocell and meter. This is being done to establish a base line for comparisons between images exposed in accordance with the present background density standard and images exposed on the basis of line density and line to background density contrast.

Such a base line will be essential during the final stages of the development of any new standards when compatibility between images to the present standard and images to the proposed new standards is reviewed. Compatibility between images is essential so that automatic printers and enlargers can generate uniform, high quality output from intermixed images generated under the old or the new standards. There are too many documents on microfilm, many of which are no longer available for remicrofilming, for the Department of Defense, or for Industry, to establish and accept a new density control standard that would necessitate remicrofilming all documents to the new standard and scrapping all microfilm images to the old standard.

One final point. Please be patient with us. There is a lot of ground to be covered, and we will be forced to proceed slowly. The target date for completion of this project is the second quarter of calendar 1968.

E-9

ENGINEERING DATA MICRO-REPRODUCTION SYSTEMS

Mr. Joseph V. Symanoskie

Chief Draftsman

Melpar, Inc.

The Engineering Data Micro-Reproduction Systems Subsection has been afforded the opportunity to work in unison with our counterparts in the Department of Defense, the EDMS Military Committee. We have been responsive, at times on short notice, to a number of requests for review, study and comments on many problems in the area of micro-reproduction. We are indeed grateful for the privilege of working so closely with the EDMS Military Committee and feel that both the Military and Industry alike have benefited.

We have just heard a status report from the Military relative to the several requirements and discipline documents. It is most gratifying to know that these documents are constantly under close surveillance and are amended as required to keep pace with the ever changing technology in the field of micro-reproduction.

Industry, however, is greatly concerned and frustrated by the inevitable byproducts of these fully coordinated Military Specifications and Standards. These byproducts appear as contract requirements in the form of slash numbered documents and interpretive documents. Such documents generally are not offered to Industry for comment prior to their issuance. They establish requirements peculiar and in some instances contrary to the fully coordinated Military Specification or Standard. They often require different techniques to be used in the preparation, inspection, handling and submission of data depending on the agency concerned. These agency peculiar variables always cause a cost increase. They require the contractor to re-educate and retrain the processing personnel and tremendously increase the chance of error which means more rejections and rework.

I have selected two examples of requirements peculiar to illustrate deviations from the basic Department of Defense requirements. These are representative of a number of such variations which add cost because of departure from established standardization.

First, in the requirement for positioning of sheets of book-form documents for microfilming, $8\frac{1}{2}$ inch by 11 inch sheet size, the current MIL-M-9868B, Paragraph 3.11.1.1 states:

> "Except as otherwise stated in this paragraph, book-form drawings or documents with sheet or page size not larger than $8\frac{1}{2}$ by 11 inches shall be microfilmed with four sequentially numbered sheets or pages to a frame so that they will appear on the processed film as shown in Figure 7." And further, "All frames for a drawing or document other than the last frame shall contain four sequentially numbered sheets or pages, except when dissimilar characteristics of the sheets or pages would prevent generation of microfilm images meeting the requirements of this specification." And still further, "The last frame of a drawing or document will contain four, three, two or one sheet or page as necessary to complete the group of microfilm images of the drawing or document."

In accordance with Figure 1 of the same specification, the reduction ratio to be employed for filming the book-form sheets is 16 diameters.

We have just heard that in the impending "C" revision to MIL-M-9868 provision has been made for the filming of book-form, $8\frac{1}{2}$ by 11 inch sheets, positioned 8 sheets to a frame of microfilm at a reduction ratio of 24 diameters.

However, despite the trend to reduce the number of microfilm frames by positioning more sheets in a frame of film, the current issue of MIL-C-9878/1(WP) in paragraph 3.2.3 states:

> "The requirements for one sheet per frame format of MIL-M-9868 apply to the microfilming of book-form drawings and documents having $8\frac{1}{2}$ by 11 inch sheet or page size." And further, "Reduction ratio of 12 diameters shall be used."

The second illustration of variation selected is in the area of inspection requirements for the microfilm and associated data.

MIL-Q-9858A, Military Specification, Quality Program Requirements, states in paragraph 1.2:

> "This specification requires the establishment of a quality program by the contractor to assure compliance with the requirements of the contract. The program and procedures used to implement this specification shall be developed by the contractor. The quality

program, including procedures, processes and product shall be documented and shall be subject to review by the Government Representative. The quality program is subject to the disapproval of the Government Representative whenever the contractor's procedures do not accomplish their objectives." And further, in paragraph 1.3, "All supplies and services under the contract, whether manufactured or performed within the contractor's plant or at any other source, shall be controlled at all points necessary to assure compliance to contractual requirements."

It is reasonable to assume that any contractor generating drawings and microfilm for delivery to a Department of Defense agency has an established internal Quality Program to satisfy the Government Representative that the Quality Assurance Provisions defined in section 4 of MIL-M-9868B are complied with.

Despite the fact that it is the responsibility of the contractor to establish an acceptable Quality Program, Amendment 3 to MIL-D-17419B contains a mandatory format to be reproduced by the contractor and used to document the microfilm inspection. Admittedly, this Microfilm Inspection Report in the Amendment is in excellent format; however we feel that the mandatory requirement for its use is directly in conflict with the requirements of MIL-Q-9858A.

A slightly different type problem in the microfilming area has been generated by the issuance of MIL-D-1000. The requirements of legibility for Form 1 and Form 2 drawings when deliverable in microfilm form is controlled by paragraph 3.14 of MIL-D-1000 which states in part, "when microfilmed in accordance with MIL-M-9868, blow-backs of Type 1, Class 1 microfilm will produce copies conforming to legibility requirements of MIL-D-5480." However, the legibility requirements of paragraph 3.14 are not applicable to Form 3 drawings. Paragraph 3.3.3 merely states in part, "They shall be legible and satisfy the intended use for the category specified." No measure for legibility has been imposed. Beware of the contract which requires microfilm of Form 3 drawings, they do exist - with built-in problems.

In summary, if slash sheets and intepretive documents are to continue to be imposed, and it appears that they will, be alert and knowledgeable, look long and carefully at the peculiar variables and be prepared to educate and re-educate your responsible personnel in the preparation of and submission of micro-reproduction data.

F. FRIDAY AFTERNOON - APRIL 29, 1966

INTRODUCTION

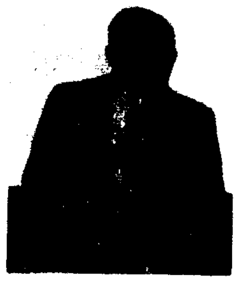
This session contains the following papers, reports and panel session presented on Friday afternoon; Presiding Chairman, J. R. Meitz; Recording Secretary, E. Ingles

- Quality Assurance of Engineering Documentation
  by Correy S. Mobley

- Systems Data Management - An Air Force Film
  by Lt. Colonel William O. Rennhack

- The Impact of Numerical Control on Documentation and Procurement Practices
  by Robert F. Franciose

- Question and Answer Session,
  Moderator: J. S. Crawford
  Panelists: P. H. Daggett, Jr.
  P. R. Durr
  R. F. Franciose
  C. S. Mobley
  W. W. Thomas for Mr. Schnabel



J.R. MEITZ
PRESIDING CHAIRMAN

E. INGLES
RECORDING SECRETARY

C.S. MOBLEY

LT. COL. W.O. RENNHACK
USAF

R.F. FRANCIOSE

QUALITY ASSURANCE OF ENGINEERING DOCUMENTATION

MR. CORRY S. MOBLEY
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MARTIN COMPANY
ORLANDO, FLORIDA

This paper will describe how engineering documentation quality is maintained. A key requirement is a document control staff educated and experienced in both technical and contract documentation.

The task of this staff is to ensure that all physical, functional, and interchangeable contract engineering design and manufacturing requirements have been met. The techniques to be described make it possible to measure the quality level and performance of engineering documentation groups. The Zero Defects program measurement techniques and the engineering evaluation system permit areas in need of improvement to be readily detected and corrected.

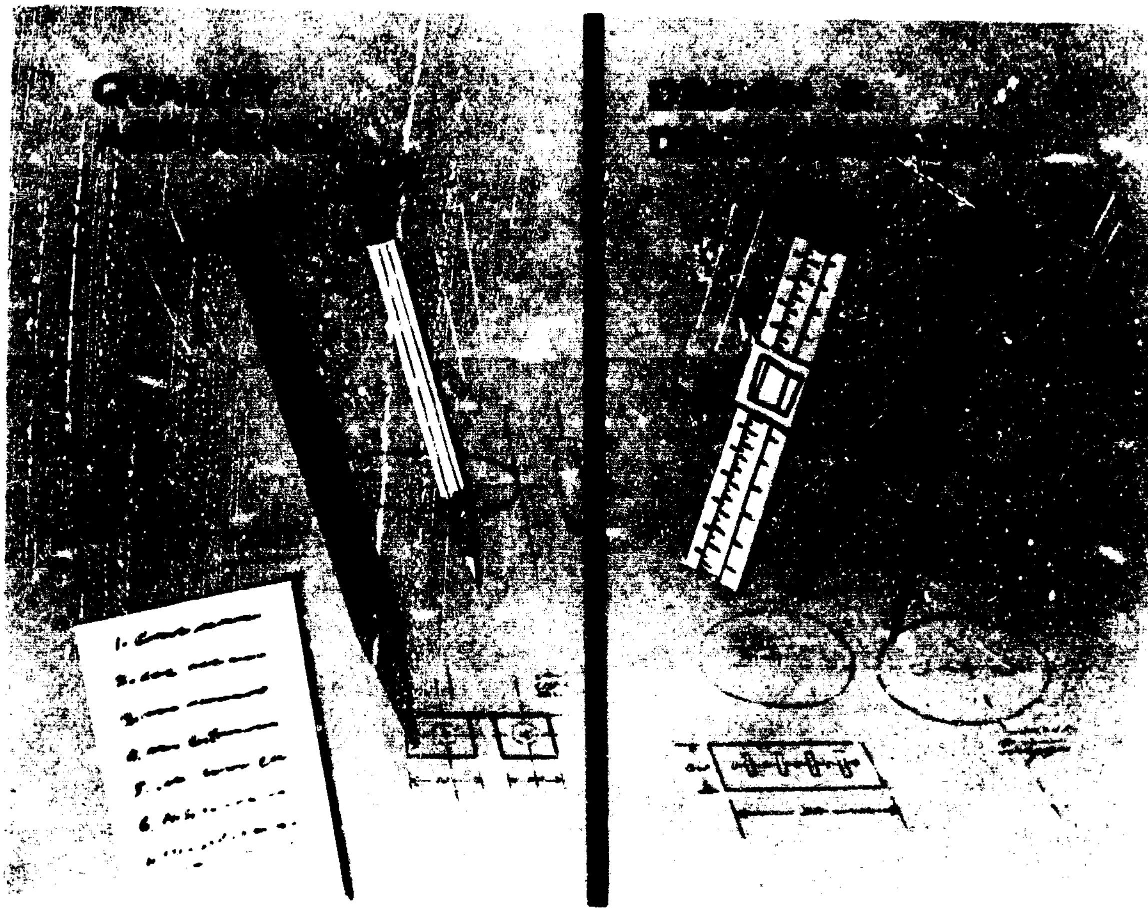
TERMINOLOGY

Engineering documentation and quality assurance are terms with many conceptions and definitions. It is because of this that it is necessary to define exactly what is meant by each of these terms. (SLIDE 1.)

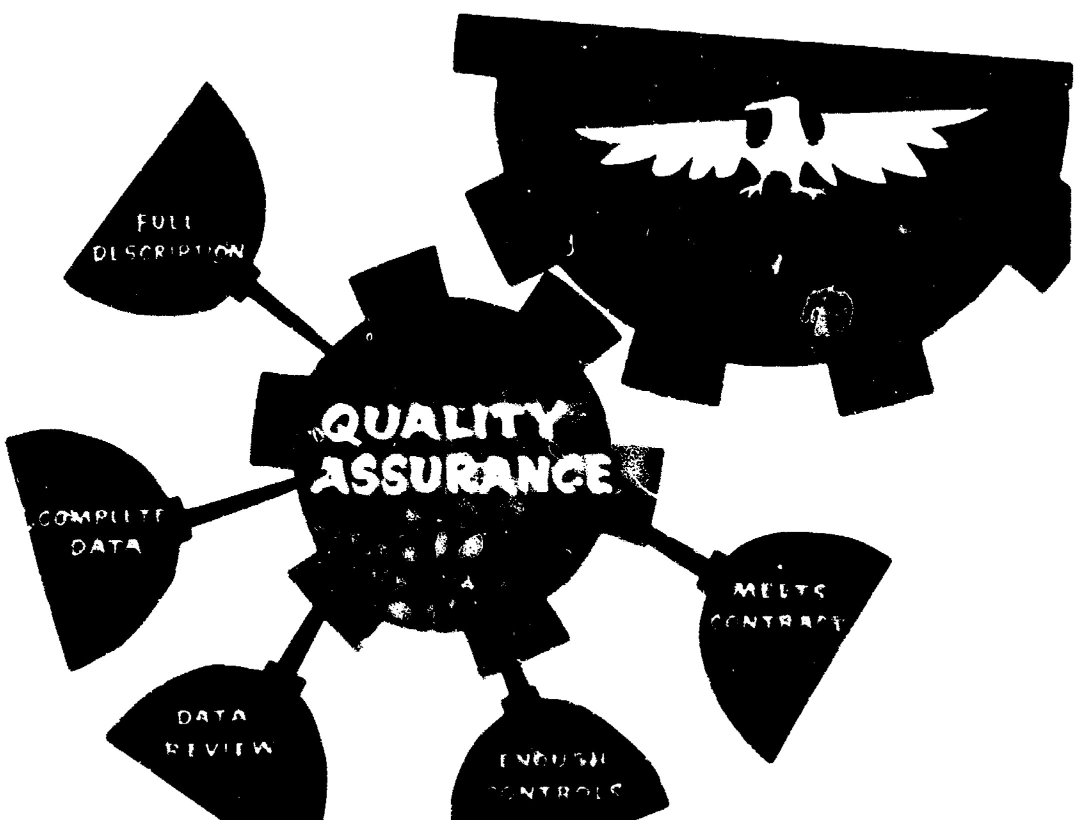
First, engineering documentation is every drawing or document that contains technical and other data which is released from engineering to procure, assemble, and maintain an item. This includes data for testing and quality inspection of the item.

Second, the quality assurance of engineering documentation comprises a complete review of an engineering package to assure that the item delineated is in fact sufficiently described and can be manufactured and field maintained at the lowest possible cost. This review should occur after the design and documentation has been finalized and is ready for release.

Included in the assurance is the guarantee that the engineering documentation package contains sufficient controls for item reliability, simplicity in operation, ease and accessibility of maintenance, and compatibility with the system in which it is to function. (SLIDE 2.) Included also is the guarantee that the technical data contained in the package is presented in such a manner that it can be easily understood and meets all the requirements of the contract.



SLIDE 1



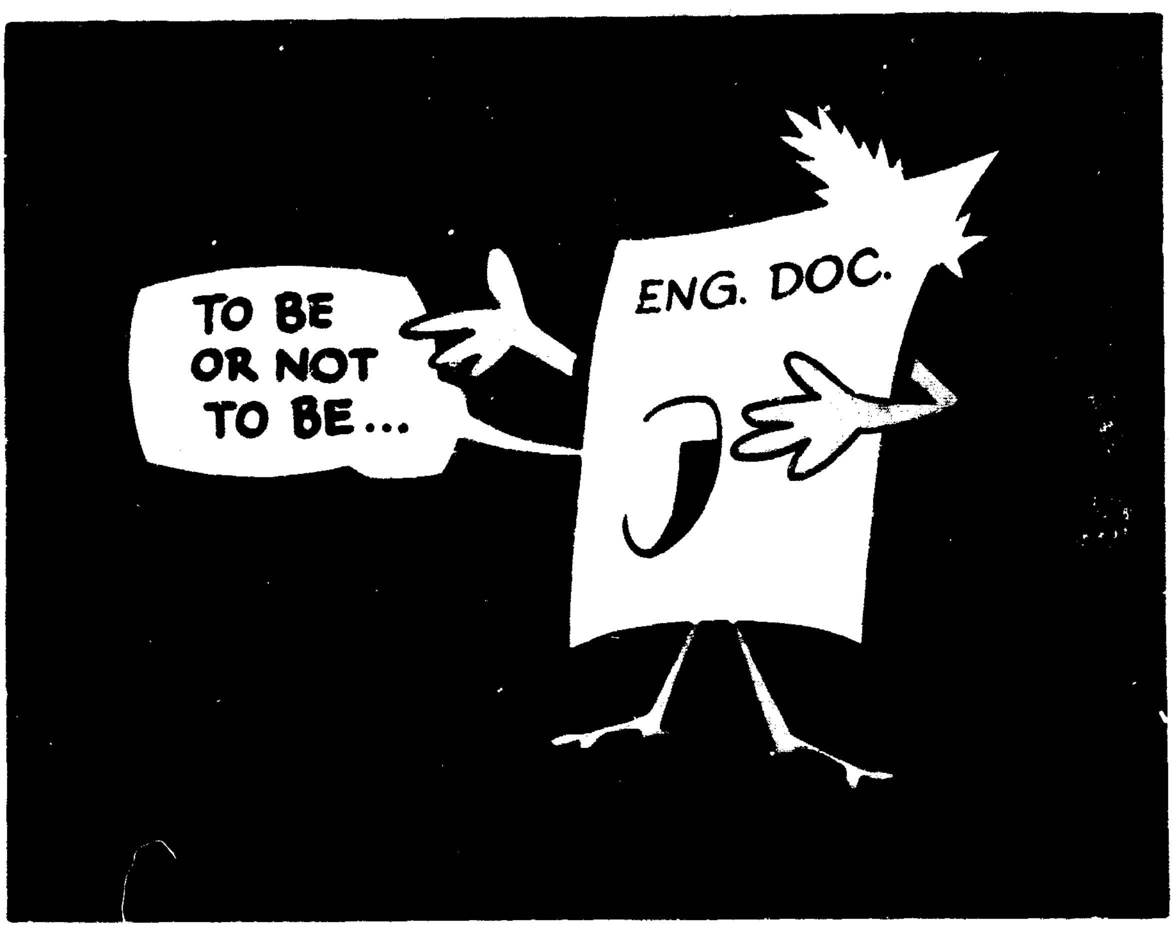
SLIDE 2

THE NEED FOR QUALITY ASSURANCE

Engineering documentation is playing a greater role today than ever before. (SLIDE 3.) Every activity, from hardware concept through manufacturing, on into field maintenance, is dependent upon the engineering documentation as its base.

To meet the demands of scientific development, our engineering departments are divided into specialized sections. This specialization is necessary in order to maintain an engineering technological level that can carry today's rapid break-throughs in science into design reality. Concentration on specialization, however, lends itself freely to poor correlation of ideas between the different fields of engineering. The possibility of design errors and loss of engineering data is too great without some degree of quality assurance. This is where a program of quality assurance in engineering pays off the most.

A complete review of the final engineering documentation by a qualified checking group will assure that proper coordination across all the engineering sections has been maintained. (SLIDE 4.) The assurance that the engineering design and documentation are accurate and meet contractual requirements can be accomplished at the same time.



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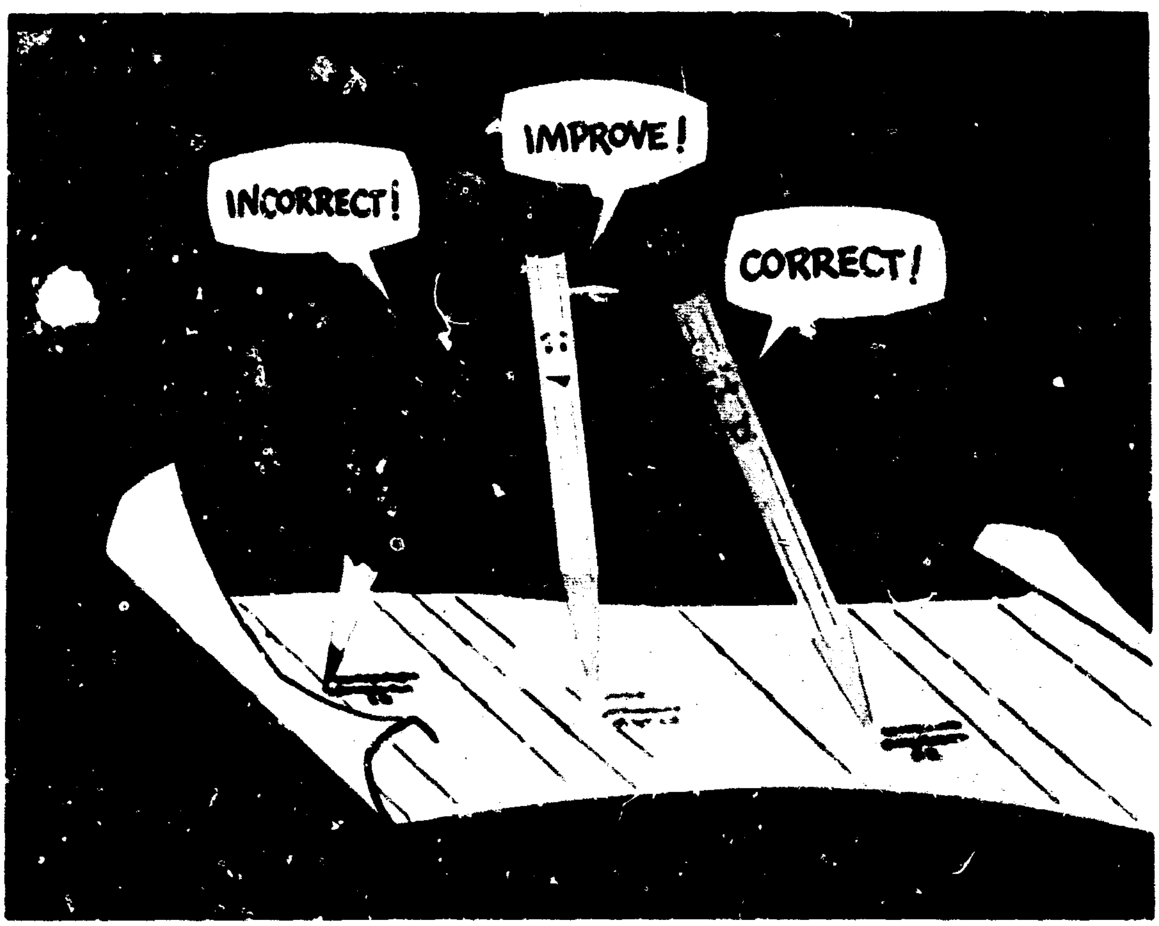


SLIDE 4

WAYS TO QUALITY ASSURANCE

There are several methods used in the industry to assure the quality of engineering documentation. Many companies accomplish this task with a review by qualified people other than those who created the design and documentation. Very few allow their documentation to be released unchecked.

In one system, engineers, designers, or draftsmen check each other's work. (SLIDE 5.) This system allows too much temptation to bypass the checking step in order to meet tight schedules. It may also become too difficult for one man to properly concentrate on the problems of both assignments and still do his work efficiently. This system gives only marginal quality assurance.

In another system, the drafting supervisor checks the design and documentation. (SLIDE 6.) At his best, he can give only a quick review because of his other responsibilities. He usually doesn't check at all, the work done by those he considers as top designers. This system gives less than marginal quality assurance.

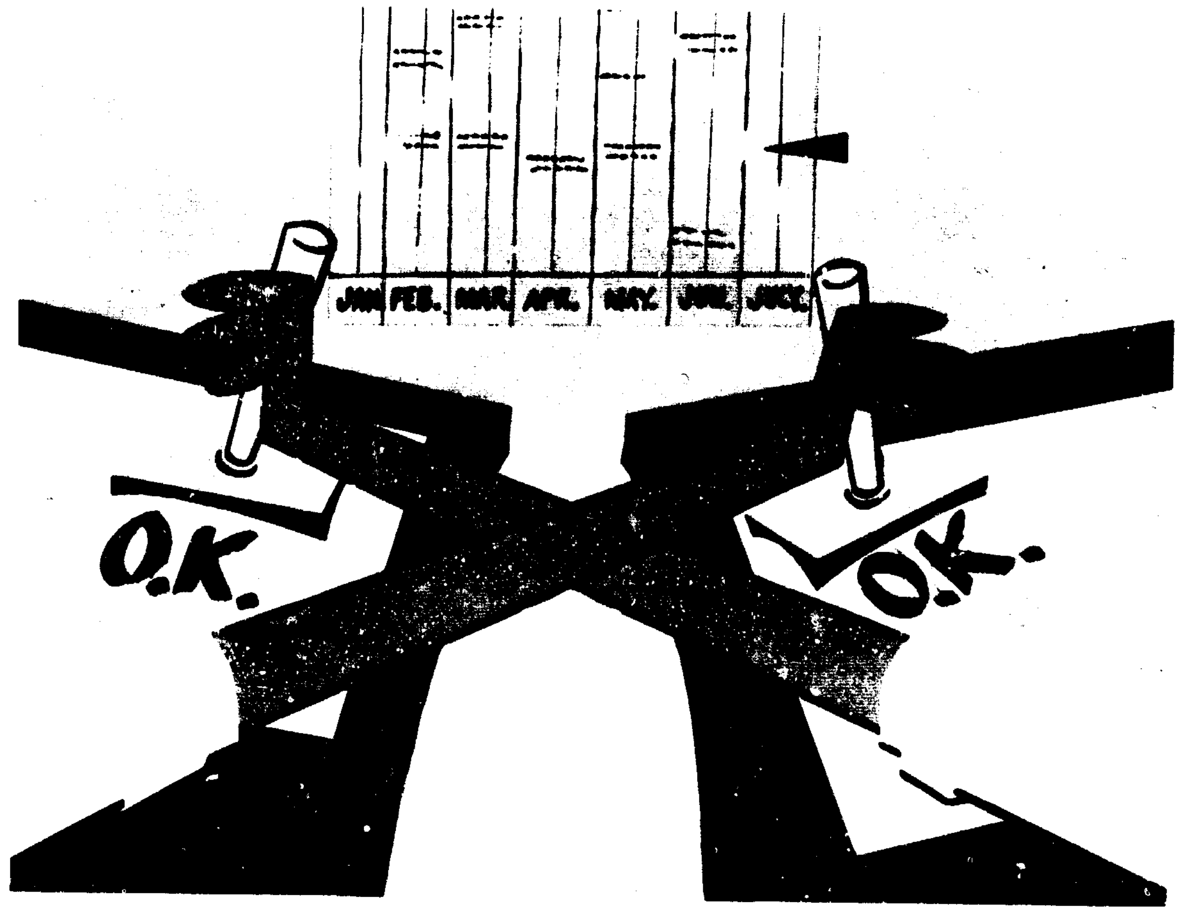
In still another system, the format is checked by one checker while the design is checked by another. (SLIDE 7.) This second checker, in many cases, is the engineer who created the design. There is no clear dividing line between format and design; therefore, this system allows too much chance for oversight and misunderstanding. The degree of quality assurance depends largely on the coordination between the two checkers involved.

There are other methods similar to those that have been described. (SLIDE 8.) All give less than the quality assurance required in today's military contracts. Some do not offer the degree of checking that will assure complete correlation of inputs from the many specialized fields of engineering.

The task of assuring the quality of engineering design and documentation can be accomplished efficiently by a team of highly trained engineers that is schooled in checking the overall technical requirements of design and the standard methods of presenting that design in final documentation form. (SLIDE 9.) The primary purpose of such a design checking group must be to inspect and assure that the design and documentation meet both company and contract requirements. All other endeavors should be discouraged as they tend to take away from the quality assurance.

Tasks such as improving design, developing new methods, and advancing the fields of engineering generally should be left to specialized people, and only the final results should be reviewed by design checking.

Design checking must concentrate on current, acceptable methods of design, documentation, manufacturing, and field maintenance, as these are the basis for the quality assurance.



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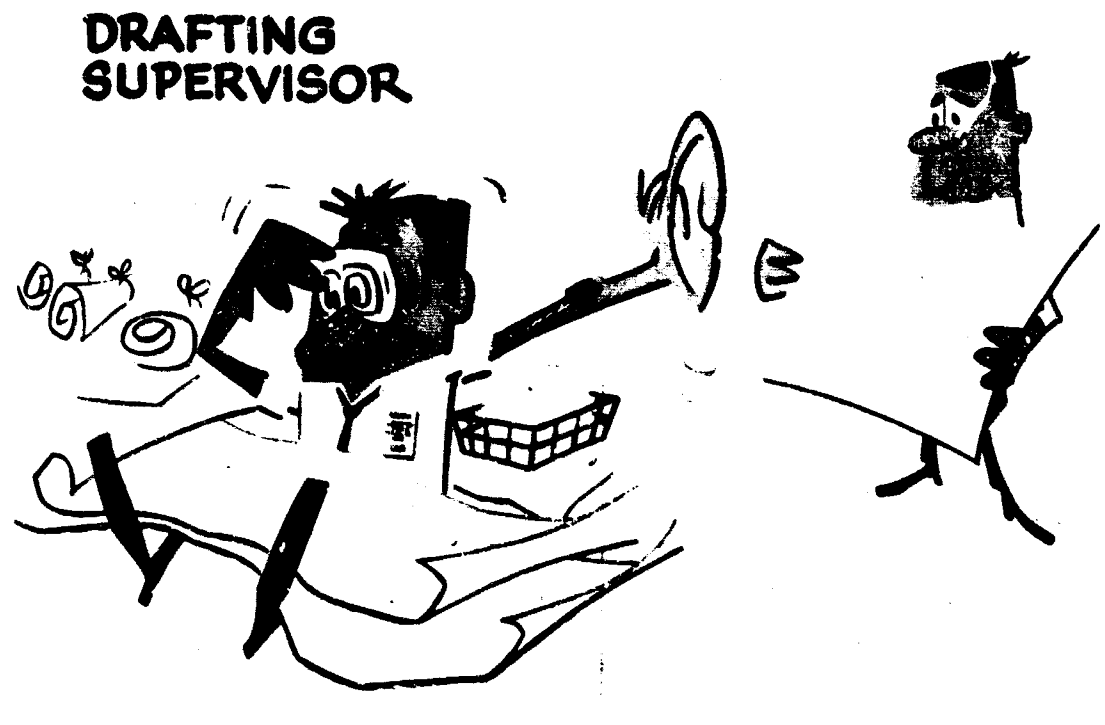

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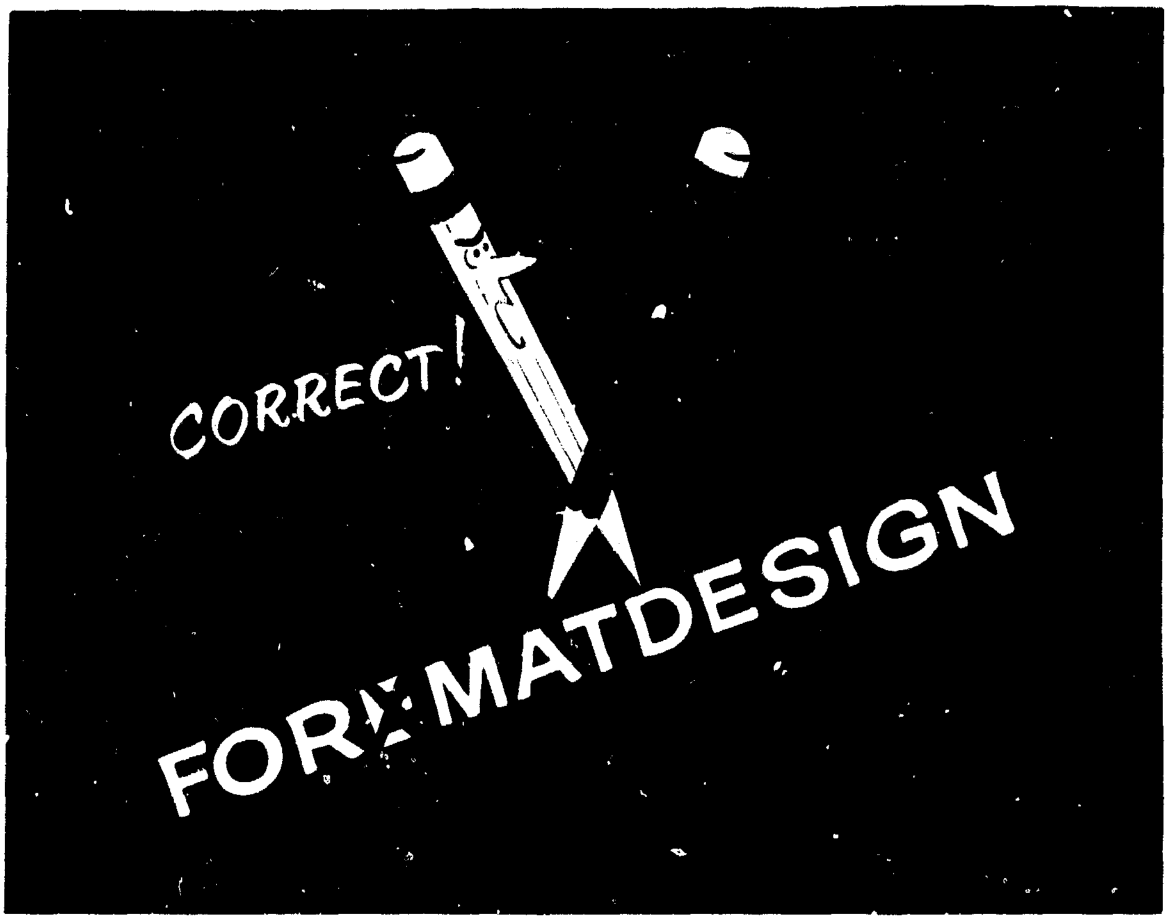

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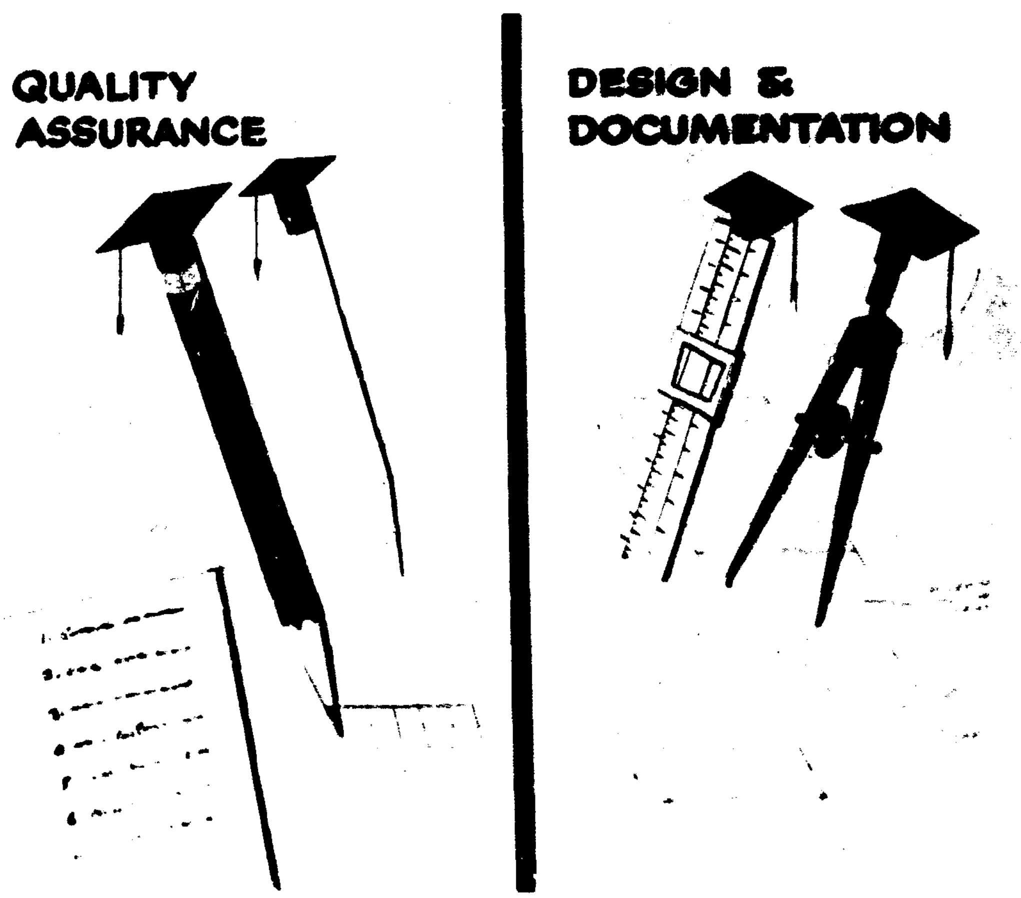

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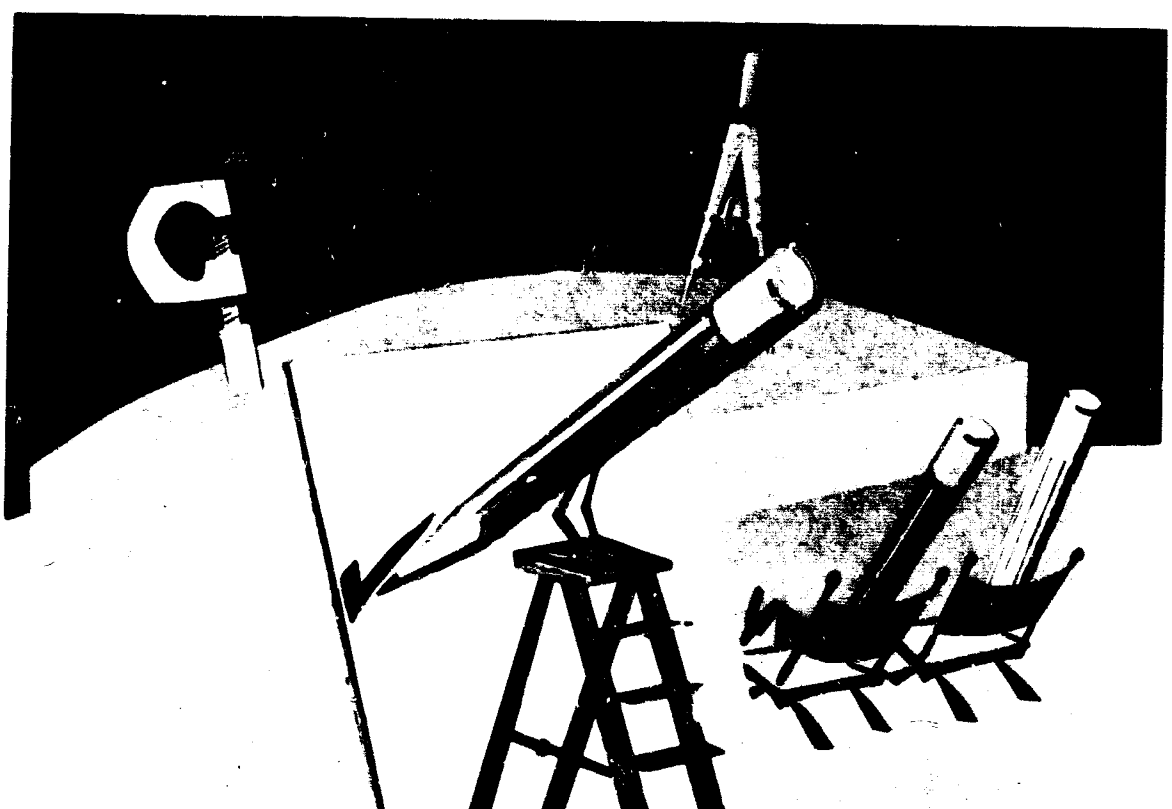
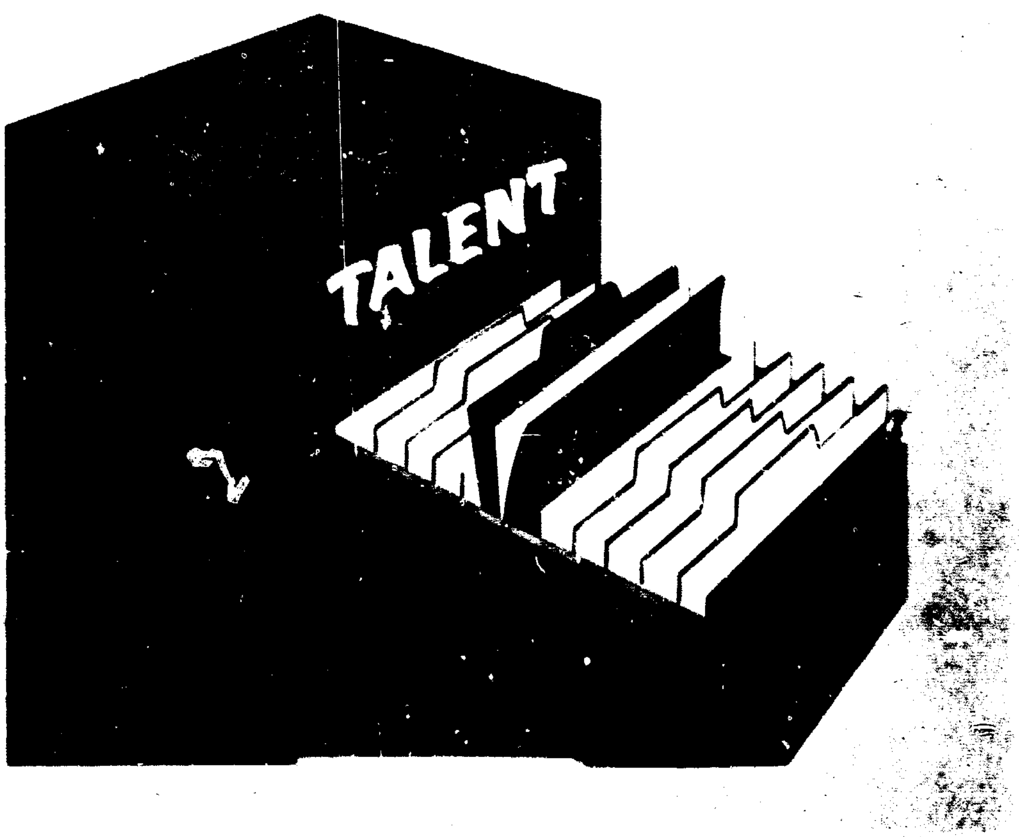


SLIDE 9

MARTIN/ORLANDO APPROACH TO QUALITY ASSURANCE

Our engineering organization is set up by department functions according to the different specialized fields of design engineering. The responsibility of each of these departments is to develop its part of the product and advance the state-of-the-art in its own particular field. Each of these departments can move its people from one program to another, depending upon the need for talent or development of the individual. (SLIDE 10.) This allows for exchange of ideas across the different programs. It reduces duplication of effort and prevents rehashing of problems. It allows for best utilization of talent and the further development of that talent.

In the engineering organization, the burden of solving documentation and system problems has been removed from the design engineer. (SLIDE 11.) This responsibility is placed with the Design Support Department. (SLIDE 12.) This department is organized into different sections covering drafting procedures, automated data processing, advance mechanized drafting techniques, federal cataloging, standards, engineering liaison, design drafting, and design checking.



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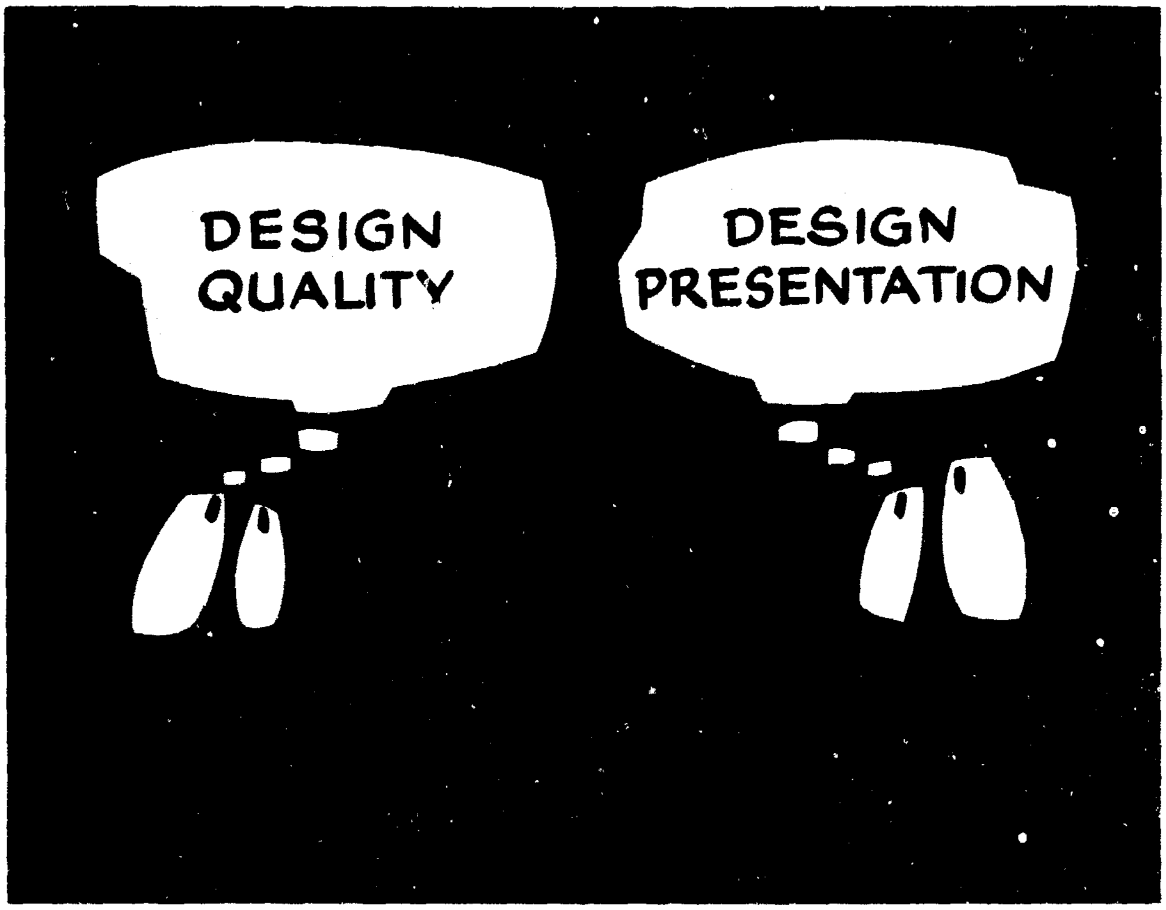
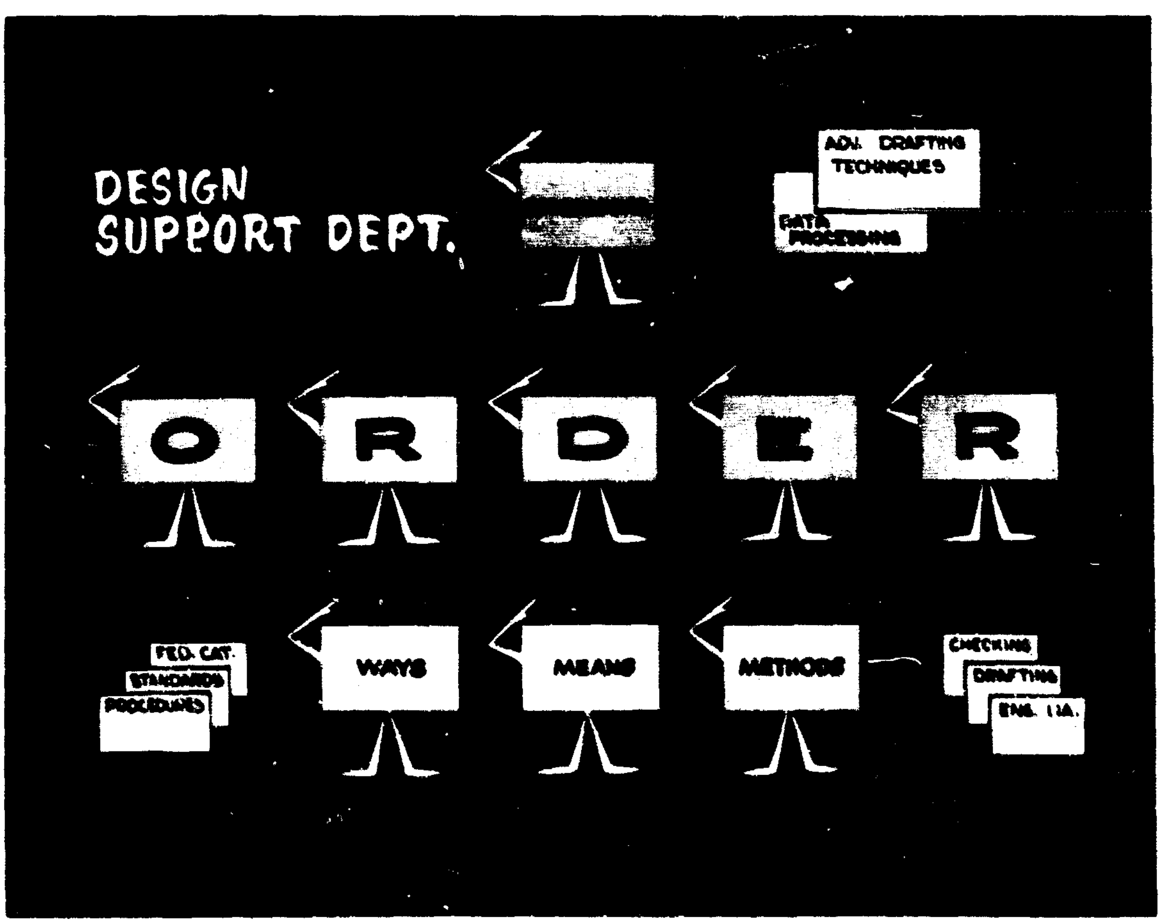


SLIDE 11



SLIDE 12

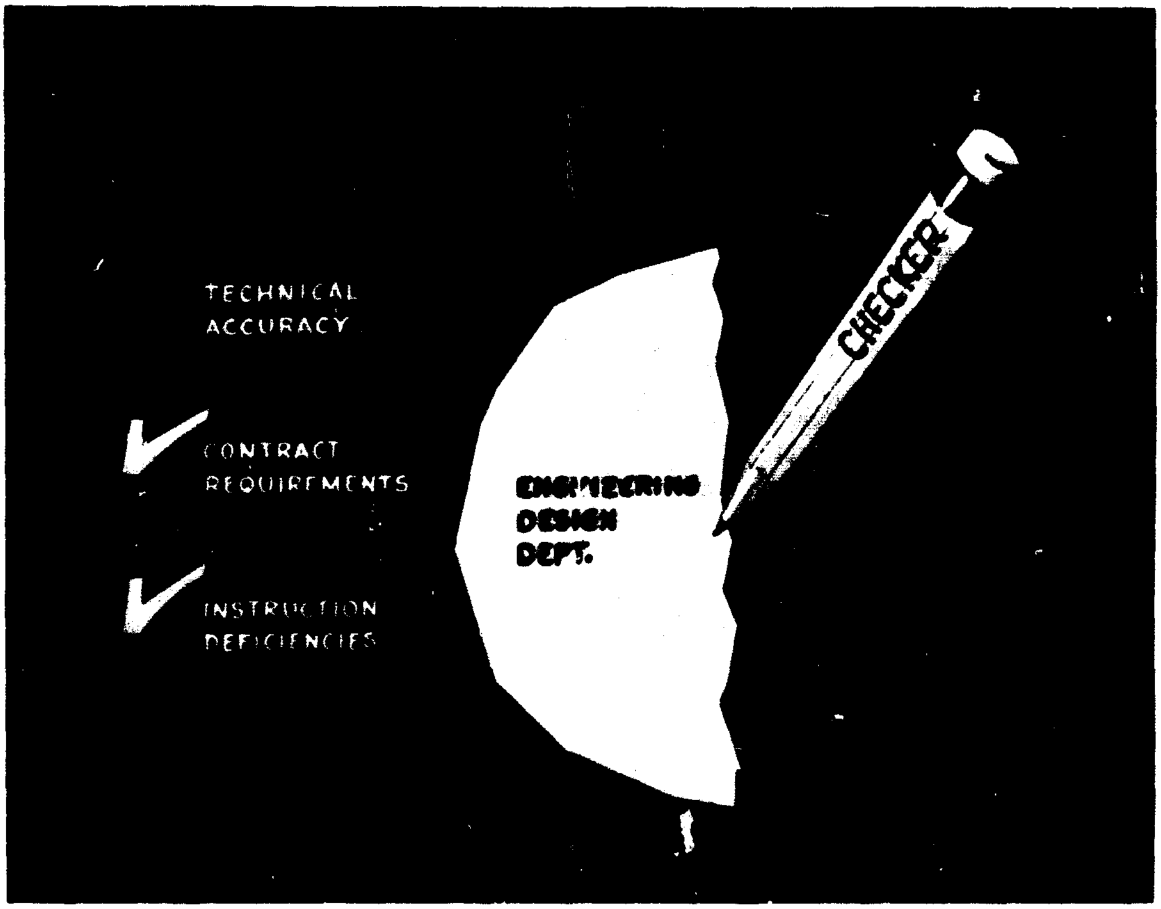
THE DESIGN CHECKER

The key to the success of the split in responsibility between Engineering Design and Design Support is the Checking section. (SLIDE 13.) This section checks and assures the technical accuracy of the design and the presentation of that design to contract requirements. At the same time, deficiencies in the instruction procedures for design drafting and data handling are pointed out and corrected.

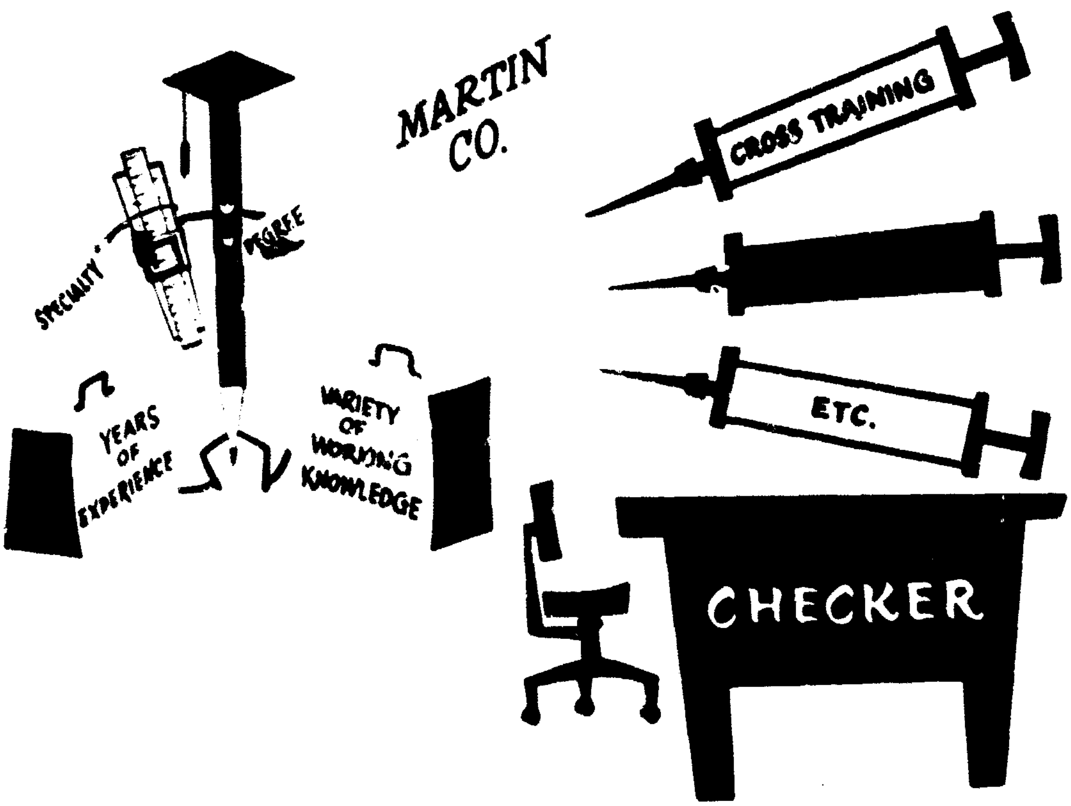
To accomplish these tasks, we have developed versatile checkers who are selected by type of education and varied experience in performing different design engineering work. (SLIDE 14.) Each must have a degree, or equivalent, in one of the fields of engineering, and at least eight years of actual design experience. Another factor in the selection of new checkers is their attitude toward design checking. Although each checker can retain his specialty (mechanical, electrical, or structural), he is expected to become proficient in other engineering fields.

The design checker is constantly being cross-trained and schooled to recognize and understand from a contract standpoint the overall engineering, design, and documentation picture. He thoroughly understands the need of the military customer to be able to procure the item he is checking from other qualified sources. Added to his background is a working knowledge of tooling and manufacturing techniques and the logistic requirements of the G.I. in the field.

While checking the engineering package, the design checker recommends ways to reduce cost in preparing documentation, in production of the hardware, and maintenance of the hardware in the field. He strives, however, to see how much good quality engineering he can pass rather than how much he can stop and redesign. His recommendations for design improvement, where there is a question of value, are left to the decisions of both the design checking and design engineering supervisors.



SLIDE 13

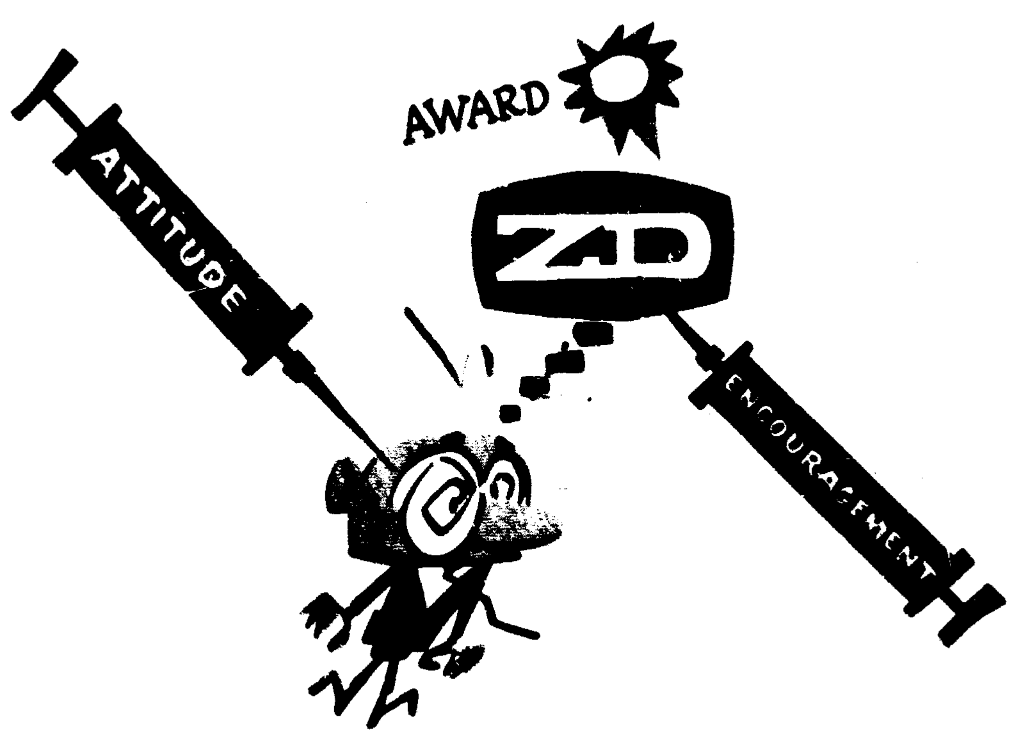


SLIDE 14

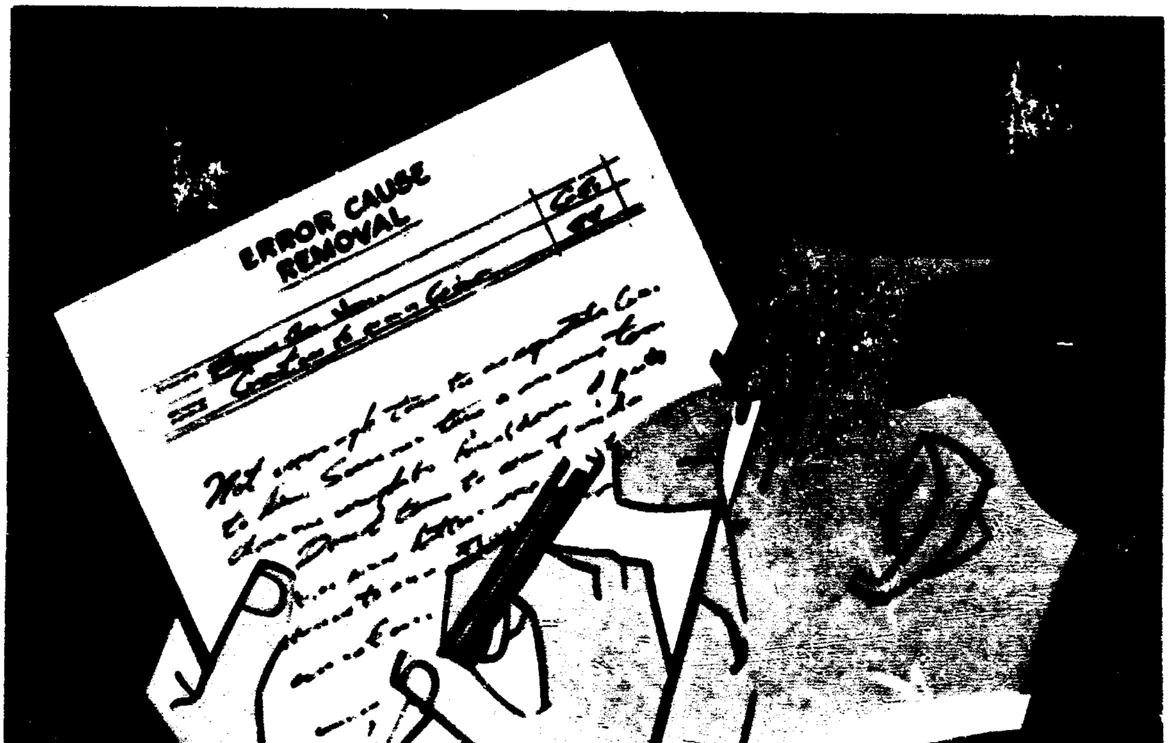
QUALITY ASSURANCE BY INCENTIVE

No system will work effectively, however, unless those involved strive to make it work. (SLIDE 15.) The backbone of our Zero Defects program is developing the attitude of doing the job right the first time. We encourage this attitude by recognizing exceptional performance. When we point out areas in need of improvement, we suggest methods the employee may use to accomplish the improvement.

This is not, however, a one-way street for the supervisor. The employee is encouraged to point out areas within the company that he finds are in need of improvement. (SLIDE 16.) He is given a means of doing this through our Error Cause Removal Program. This program offers the employee an opportunity to get something done about any condition that may cause errors to be made. Each report is evaluated and answered. The condition is improved if at all possible.



SLIDE 15



SLIDE 16

ENGINEERING EVALUATION

To give the supervisor a tool that can be used to gauge performance and detect the area and type of improvement needed, we have developed a two-phase system of error tally.

In the first phase of this system (SLIDE 17), the design checker totals the number of correct and incorrect entries or removals that were found while checking the engineering job. He enters these according to the type of error onto an error tally card, along with the design drafting supervisor's employee number. A separate card is prepared for each document in the job package.

The second phase of this evaluation system (SLIDE 18) is the corrective action feedback. When a change must be made to correct an error in a released drawing, an error feedback card is prepared by the checker verifying the correction. This card carries the number of the drawing involved, the type and number of errors corrected, and employee number of the checker who was responsible for passing the error.

At the end of the month, each supervisor receives a breakdown of his group's total count, its percentage of error, and the position it holds in relation to other groups on the same program. The types of errors are also included.

Each monthly report gives the engineering supervisor an opportunity to evaluate the quality of work produced by his people. The percentage of error is based on the total number of errors made regardless of the type. (SLIDE 19.) Therefore, the supervisor must look closely at the type of error in order to recognize a true value in the work quality of the employee. He may use the marked-up checkprints to determine the exact improvement needed and set up appropriate training programs.

As a means of assuring consistency and accuracy in the evaluation of design and drafting work, the design checker follows a set of instructions. (SLIDE 20.) These instructions are devised to allow credit according to the amount of design drafting work involved and the possibility of an error being made. The instructions were tested, evaluated, and corrected for more than 12 months before a fair comparison could be made between the different types of design drafting work. We believe this system meets the engineering evaluation requirement in MIL-Q-9858.

The engineering evaluation system provides a means for each engineer, designer, or draftsman to know the quality level of his work and the areas in which he could improve in order to advance in salary and position. (SLIDE 21.)

The engineering evaluation system is also used in determining the Zero Defects awards that are given for outstanding performance in maintaining engineering quality. (SLIDE 22.) Recognition in the company is given the employee who maintains a quality for four consecutive months which meets or exceeds the Zero Defects goal set up for his group. A copy of the commendation he receives becomes part of his personnel records. He is also awarded a Zero Defects pin as a token of his accomplishment.

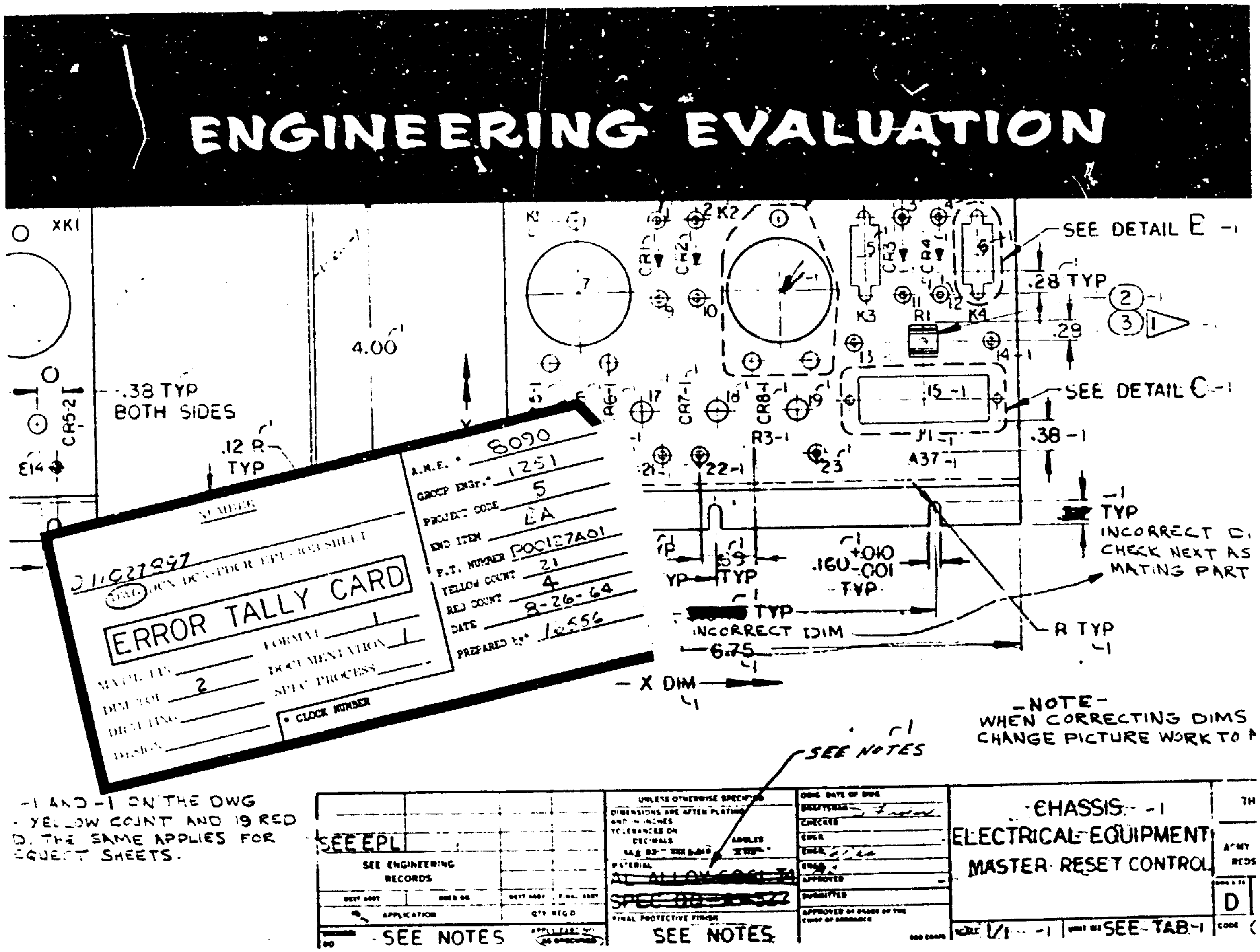
Consideration is also given the group or section that has met or exceeded their Zero Defects goals for four consecutive months. (SLIDE 23.) They are awarded a placard which is displayed in the group area for permanent recognition. Also displayed in the group area is a quality score board showing the group's average percentage of errors for each month. (SLIDE 24.) Included on this score board is the quality level the group must reach in order to meet their Zero Defects goal.

The system should not in any way be used as a weapon against the individual employee. (SLIDE 25.) Such misuse will cause the employee to be oversensitive to the system. The checking function would become a police force. The design and drafting personnel will lose their incentive and be afraid to act until they obtain instruction from checking. Some may even attempt to hold documentation from release until the error tally is made. Time could be wasted in trying to talk the checker into a better tally count. The whole system becomes a bottleneck and totally ineffective. Quality and quantity suffer the most. Each supervisor must guard against any misuse of the system.

We have found, however, that with proper application of the engineering evaluation system, performance can be improved.

Since the implementation of the system at Martin/Orlando, the percentage of error made by engineering in preparing documentation has decreased from 17.4 percent in 1961 to less than 3.9 percent today. (SLIDE 26.) These are overall engineering averages. Design and Documentation work on a new program will average as high as 6 percent.

Quality, in design and documentation, is the responsibility of each member of any engineering team. Each individual must make this a habit in every endeavor he undertakes. Reducing errors in the preparation of engineering documentation will reduce the cost of a quality assurance program.



SLIDE 17

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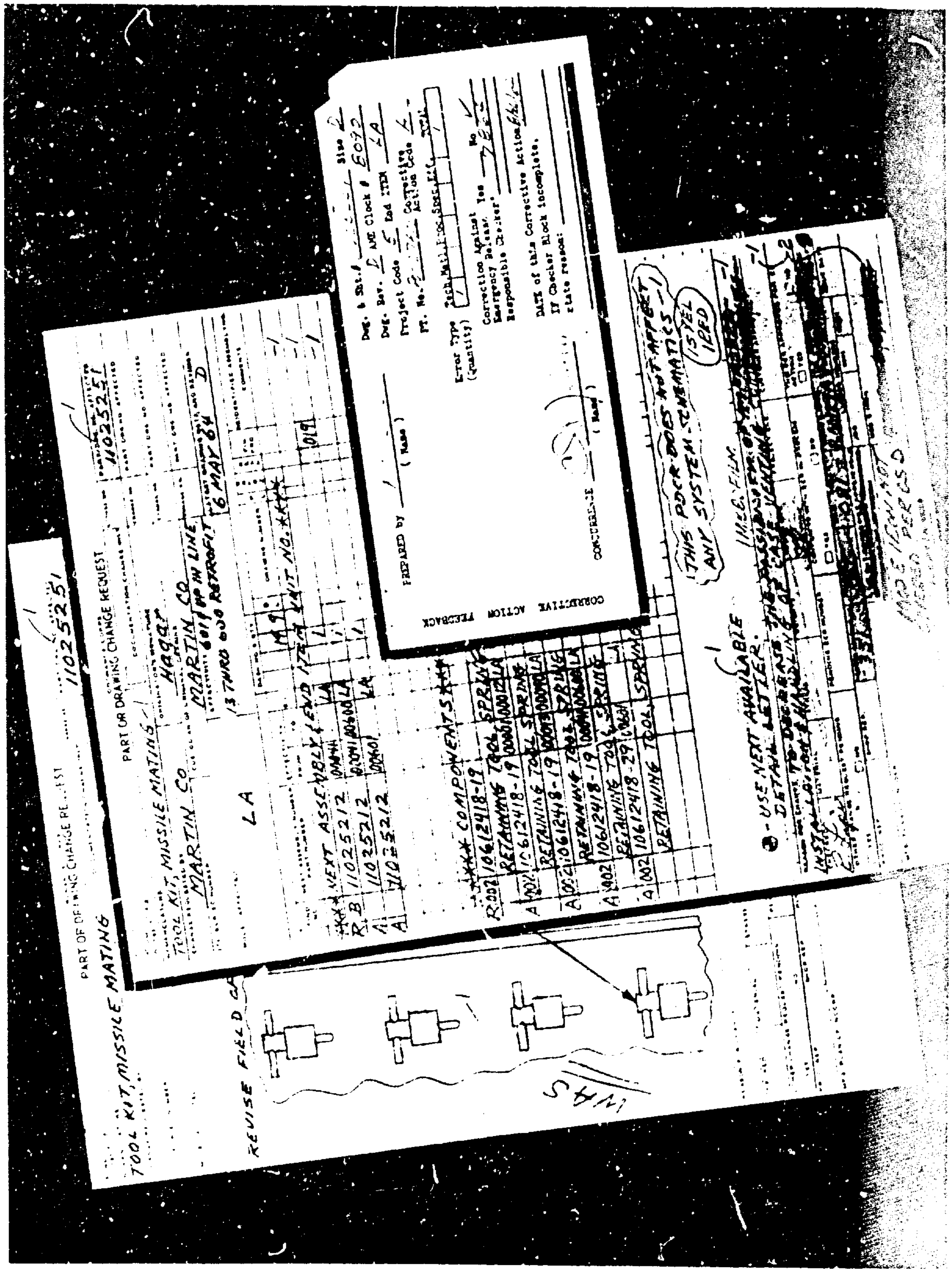
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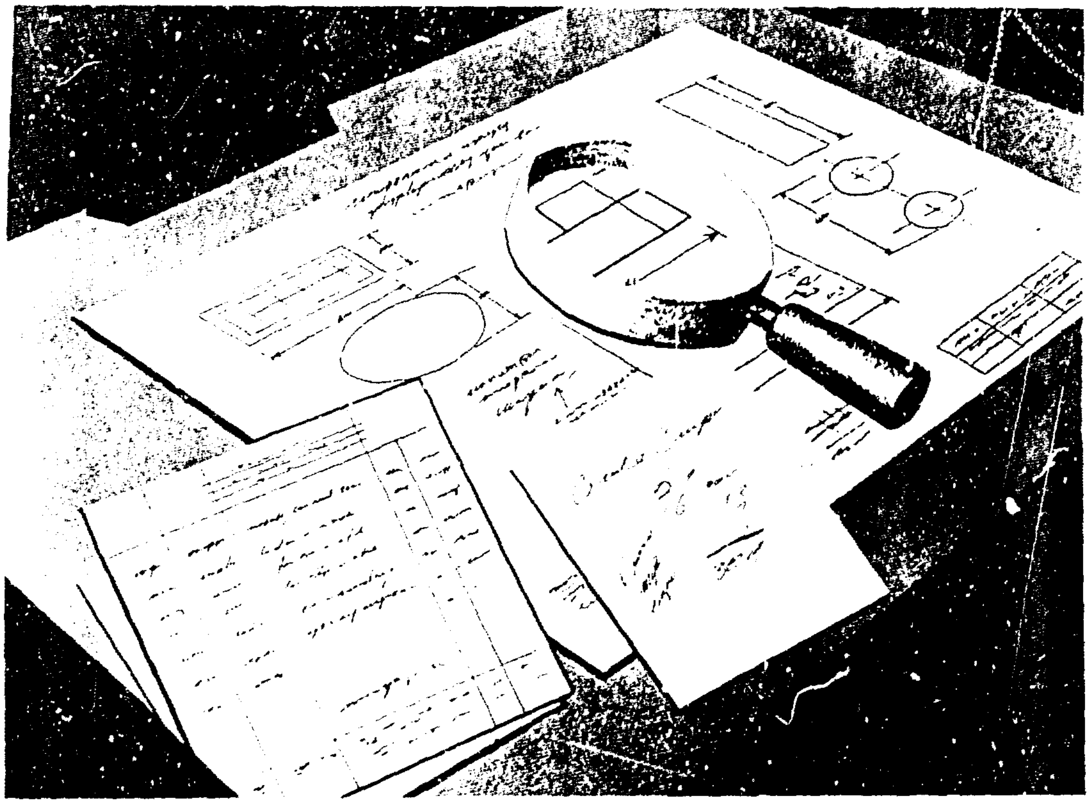
SLIDE 18



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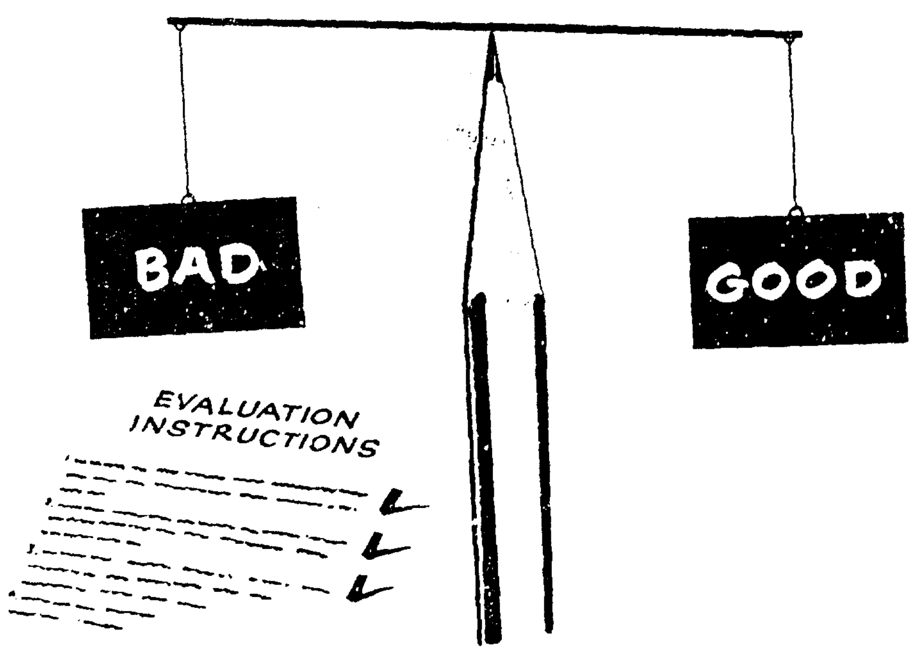

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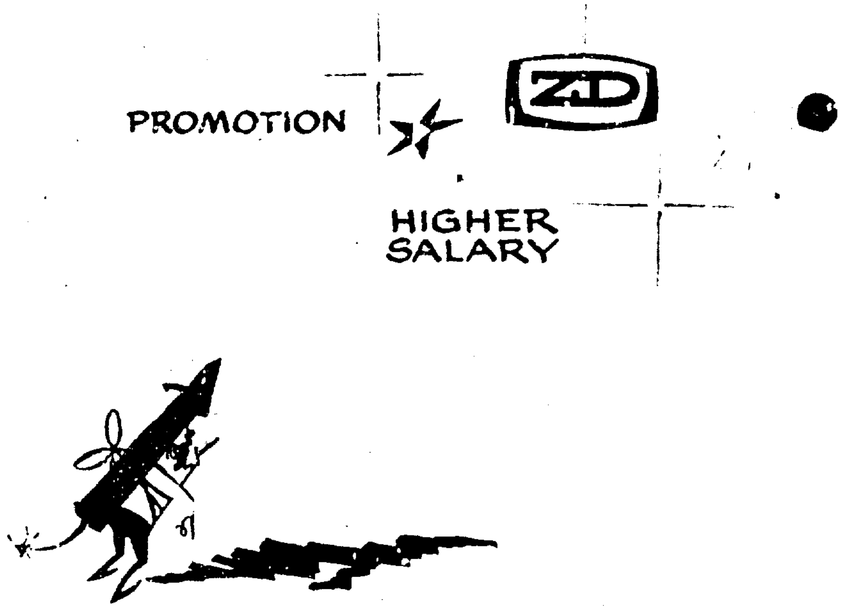

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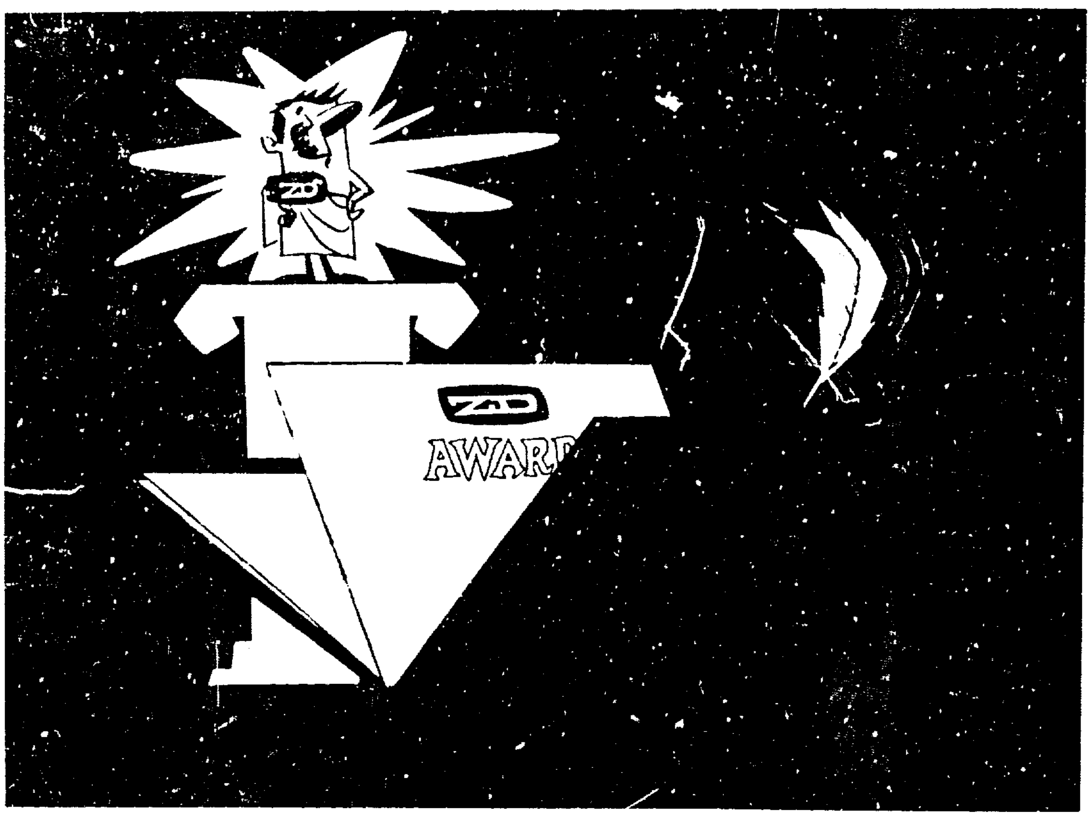

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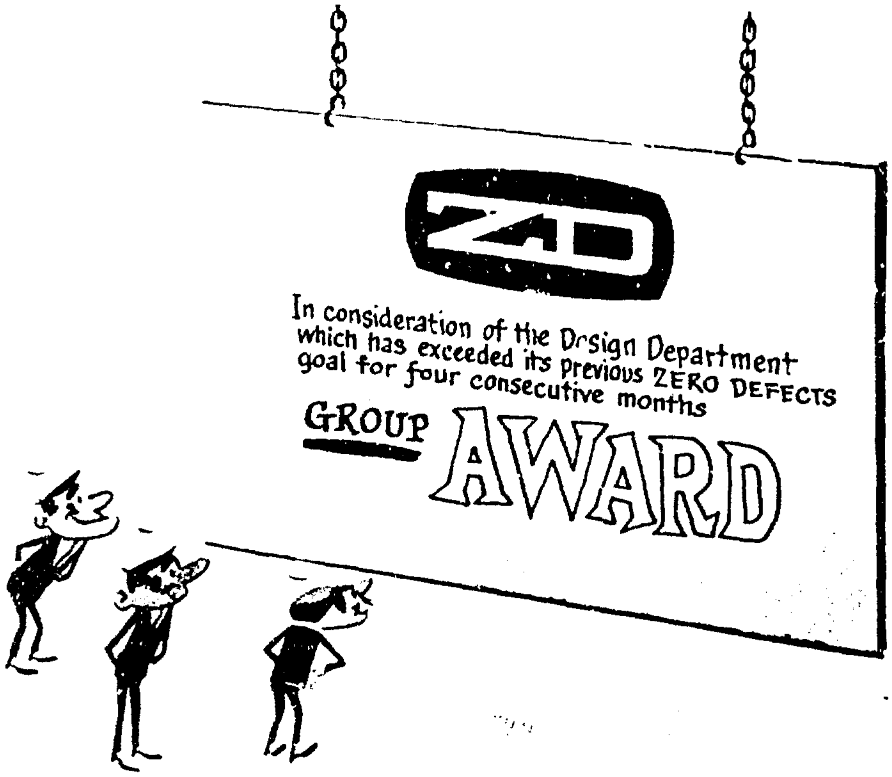
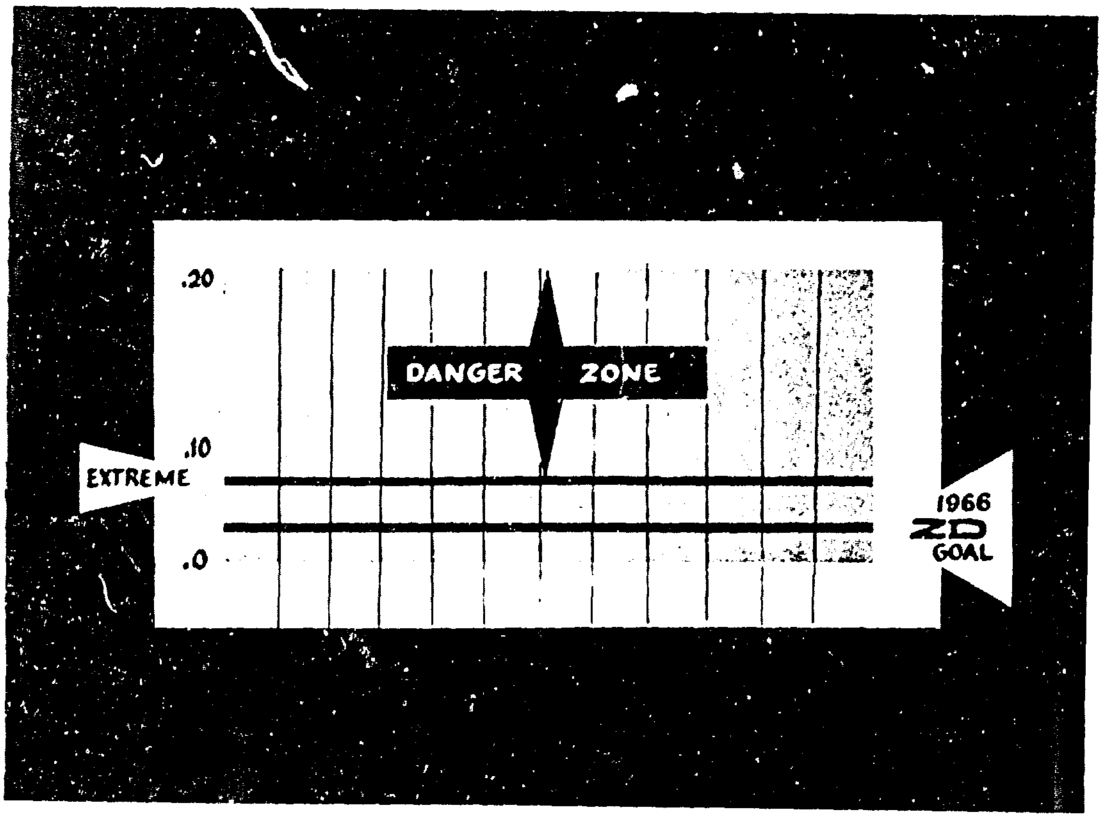
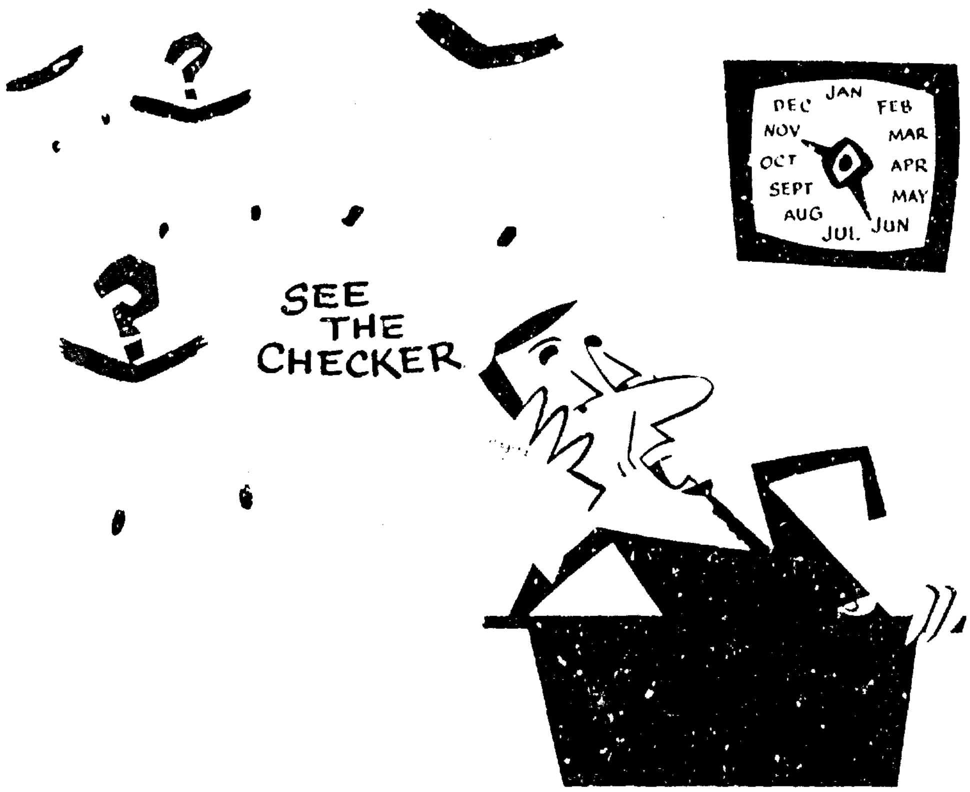


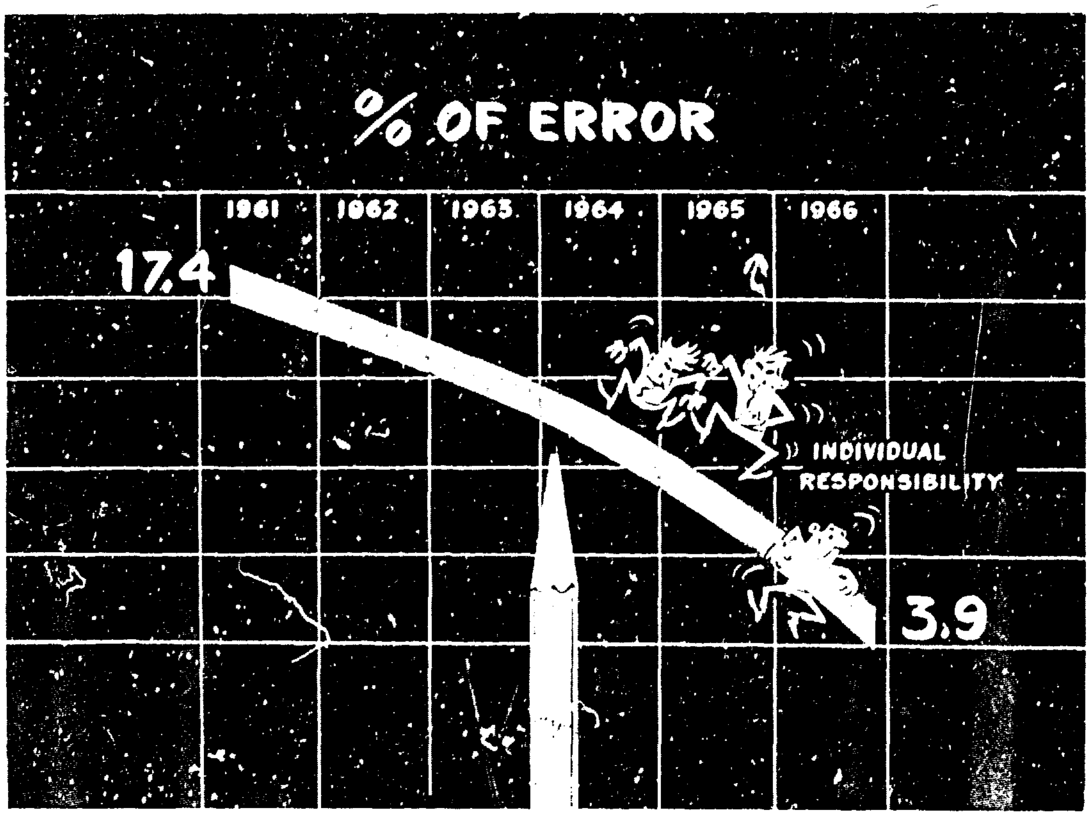
SLIDE 23



SLIDE 24



SLIDE 25



SLIDE 26

HOW FAR WITH QUALITY ASSURANCE

The question arises, "How far should engineering carry its quality assurance program?" (SLIDE 27.) If we follow MIL-D-1000, we would have such a program beginning with the R&D phase, through production and into a maintenance program.

The engineering departments of many companies are skeptical as to the value of such a program, when its cost in time and money is considered. Some feel that it would slow down the final development of the design.

This skepticism could be removed if an analysis is made of the cost of an R&D program without quality assurance in the areas of material scrappage, time spent in debugging the equipment, and the amount of design cleanup after the start of production.

Some engineers believe that if parts, assemblies, and equipment can be manufactured to engineering documentation, the quality of that documentation has been assured.

This is not true. The capability of manufacturing parts, assemblies, and equipment to drawings by one source does not assure interchangeability with parts, assemblies, and equipment manufactured to the same drawings by another source. (SLIDE 28.) Nor does it assure that the G.I. in the field has access in the equipment to troubleshoot and/or make repairs. This we should have learned from our hardware problems of World War II. (SLIDE 29.) With the types of cost incentive contracts that are being awarded today, it would appear mandatory for each company to have some degree of quality assurance before bidding on the next contract phase.

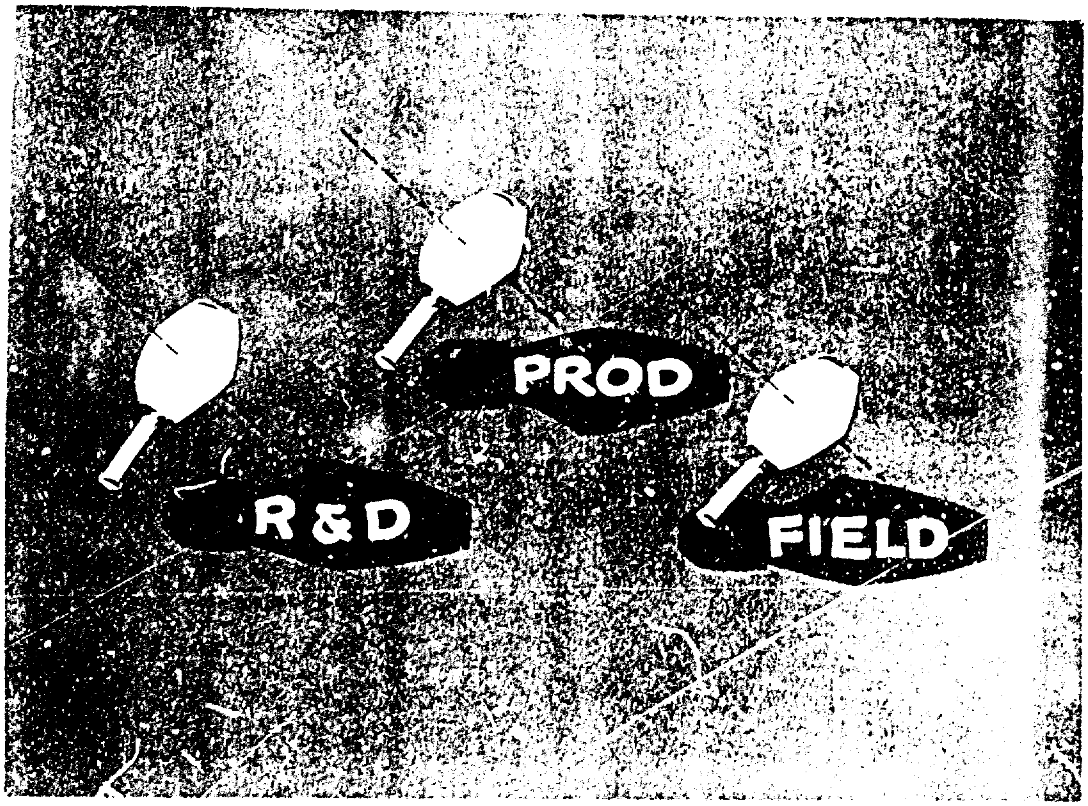
With the approval of MIL-D-1000 and its provision for the use of MIL-Q-9858, the quality assurance of engineering design and documentation is being enforced in many of our contracts. (SLIDE 30.) Our Department of Defense will accept nothing less than what is being paid for.

Since World War II, there have been many attempts by DOD to give instructions that would assure consistency and accuracy in our documentation. (SLIDE 31.) The quality assurance provisions have increased to the point that not only does DOD expect a detailed inspection of engineering documentation to assure accuracy, they also require proof of compatibility with the hardware.

The agencies of our military must have documentation from which they can procure, assemble, and maintain an item produced by any of their qualified sources without further research or development.

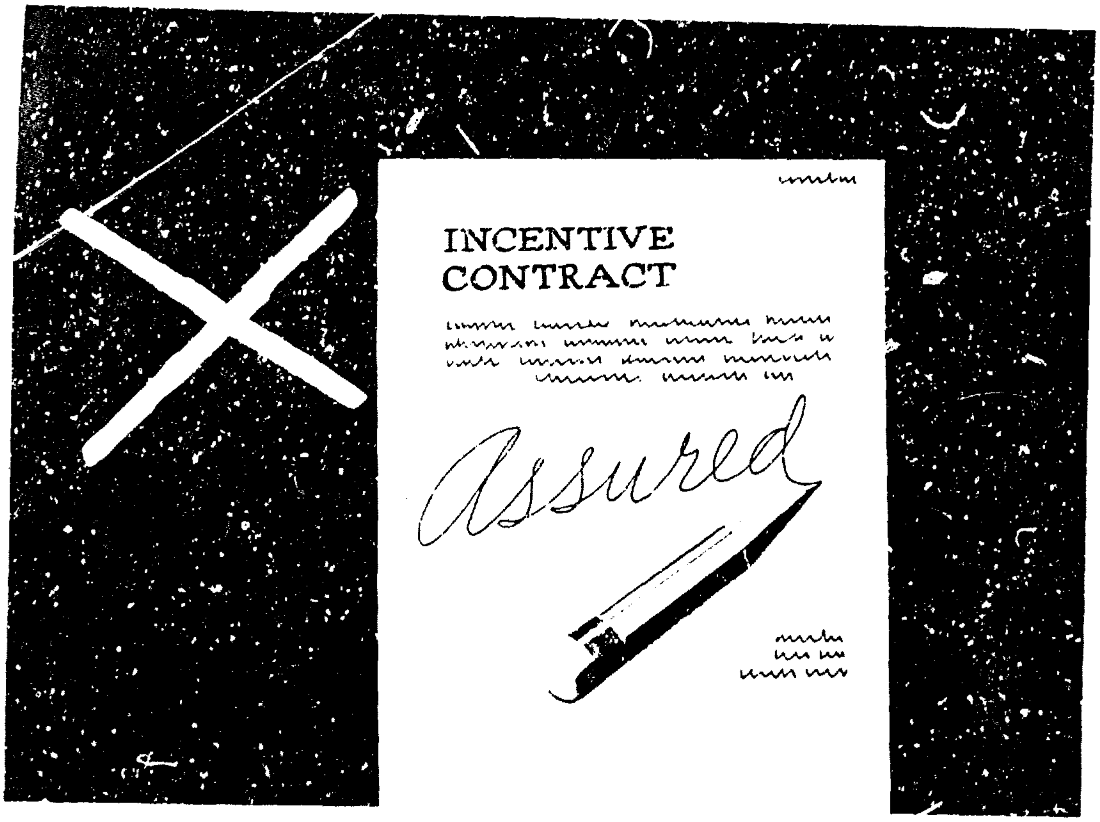
Experience should teach us that if we in the industry do not meet today's requirement in engineering documentation, DOD will impose tighter controls tomorrow. (SLIDE 32.) As this happens, the cost of engineering documentation will go up.

We can prevent this from happening, first, by knowing the full scope of the needs of our military customer and clearly understanding his meaning of producibility, reliability, and maintainability of hardware from any qualified source. (SLIDE 33.) Then, assure him the means of satisfying his needs through the quality of our engineering documentation.



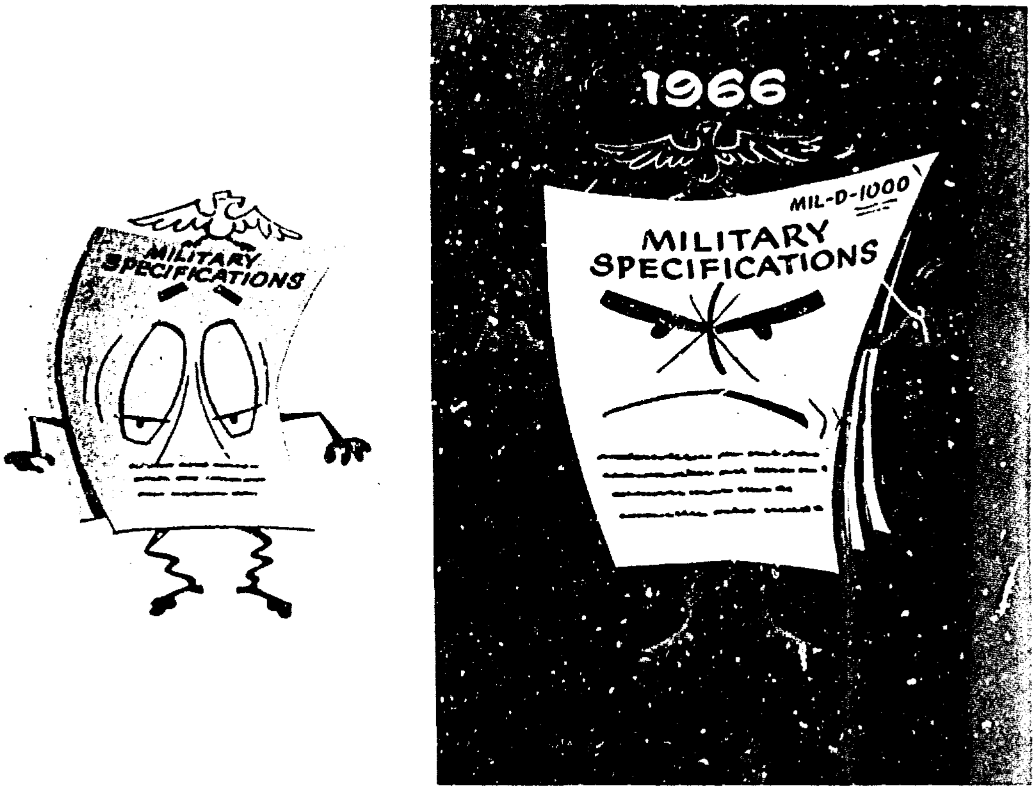
SLIDE 27

SLIDE 28



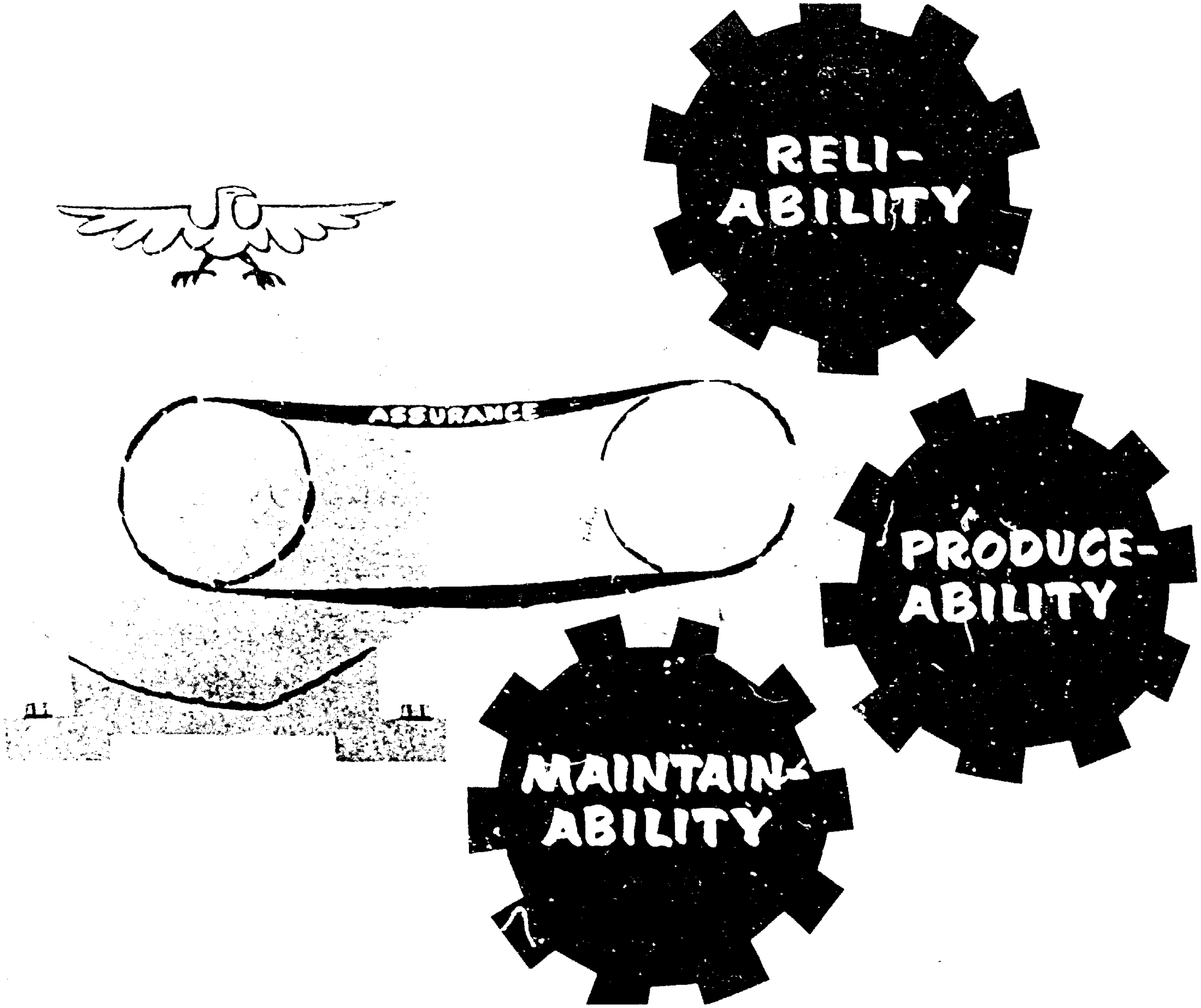
SLIDE 29

SLIDE 30



SLIDE 31

SLIDE 32


RELI-
ABILITY
ASSURANCE
PRODUCE-
ABILITY
MAINTAIN-
ABILITY

F2 SYSTEMS DATA MANAGEMENT (AN AIR FORCE FILM)

LT. COLONEL WILLIAM O. RENNHACK
CHIEF, CRITERIA DIVISION
HQ, AIR FORCE SYSTEMS COMMAND

The film outlines the duties of the Data Management Officer. It shows the interface of the data generators during a data call. It states the need for justifying data requirements and reviewing them for redundancies and duplication. The use of the new form 1423 is described, along with the detailed procedures for filling it out.

F3

IMPACT OF NUMERICAL CONTROL ON PROCUREMENT AND DOCUMENTATION PRACTICES

MR. ROBERT F. FRANCIOSE
ENGINEERING ADMINISTRATIVE CONSULTING SERVICE
GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

There are any number of possible numerical control drawings. Two are shown in Slides 1 and 2.

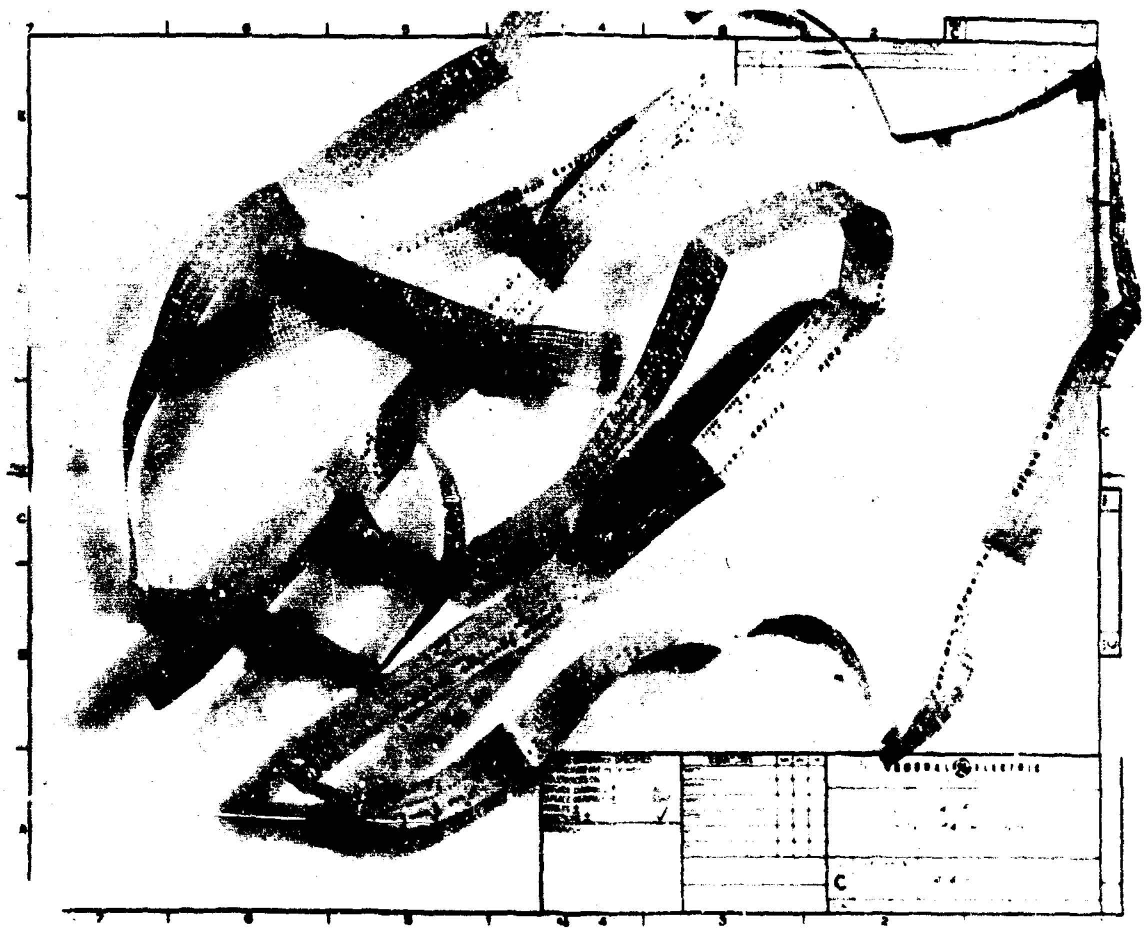
All have one point in common--they are all shown on a standard drawing format--and the similarity ends there.

As you know, aside from the inherent accuracy of NC equipment, one of the principal advantages of numerical control manufacturing is the quick turn-around capability that it provides with a minimum of investment in capital equipment and tools. Among other advantages that it provides are reductions in lead time, fixture costs, inspection costs, scrap loss, and inventory costs. Moreover, the method improves quality and scheduling because of the tight manufacturing disciplines which are involved. The further flexibility provided by coupling a computer to the NC machine literally makes the process open-ended and provides greater flexibility in design. (SLIDE 3.)

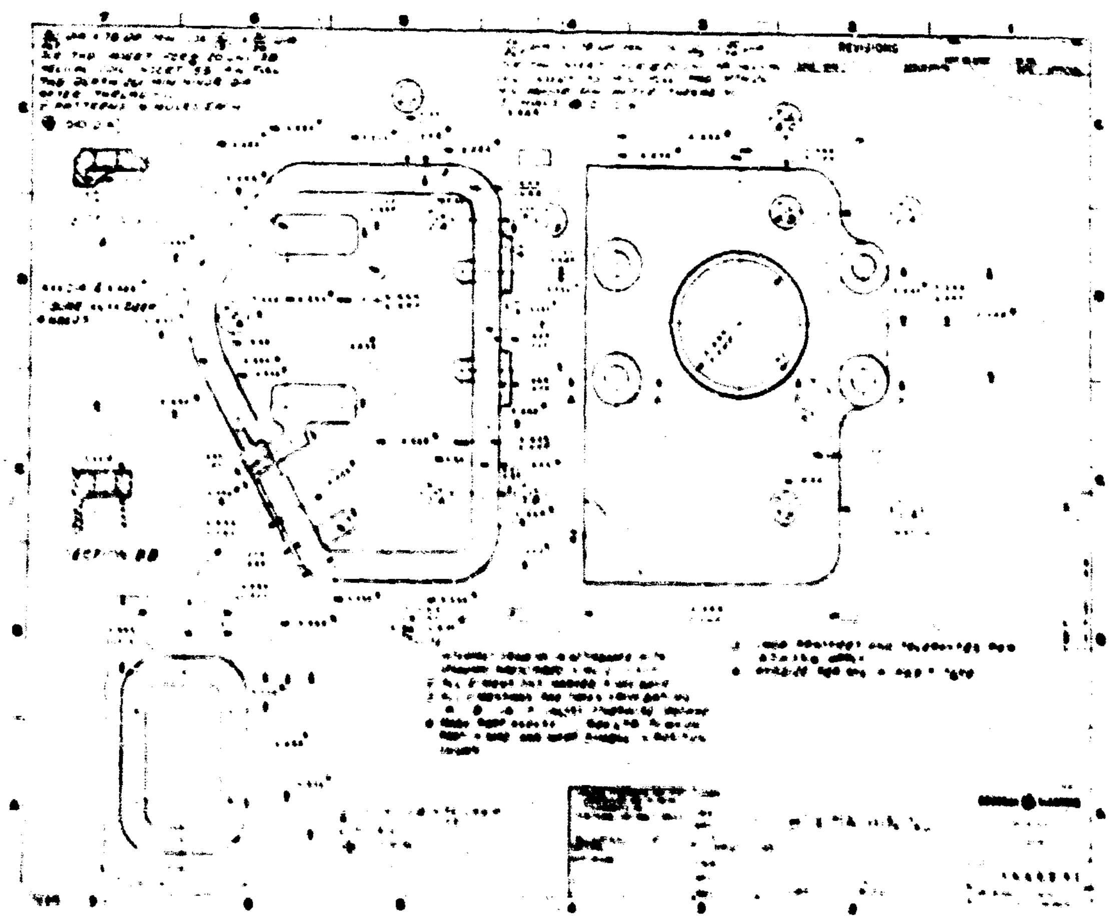
Much of this advantage is derived through a minimum of documentation--substantially less than that required for conventional manufacturing. For example, the techniques for reverting from the drawing layout and hence to the piece part without the benefit of conventional documentation are known to many of us. Much of the normal feature controls associated with conventional manufacture are no longer required to be specified on the drawing. In fact, in many cases, parts will be produced more accurately than is necessary because of the innate characteristics of the process. Thus, a quantum jump from the layout to the tape is sound and should be fully exploited.

As early as 1956, George A. Price conceived the idea of the design machine shown in Slide 4. In his work on the Manhattan Project and at Bell Telephone Laboratories, Mr. Price was acutely aware of the need to speed up the process from inventiveness to producibility. He envisioned an electronic device tied into a computer placed at the designer's disposal which would not only record the designer's decisions but would generate the direct programing of numerically controlled machine tools. To date, I am unaware that such a machine has been built, but if it were, I would envision that the life of the new breed of designers would be something like this. (SLIDE 5.)

Is this a pipe dream? Not in the least! Let's look at what is going on in industry. Computers, numerical control processes, and automated design techniques are beginning to have a substantial impact in the design-to-production cycle. For example, Business Week reports that in the automotive industry, the Riviera has a number of panels and Pontiac has fenders stamped from dies which were formed on NC contouring machines. Comparable components were similarly produced for the Mustang and other Ford products.



SLIDE 1



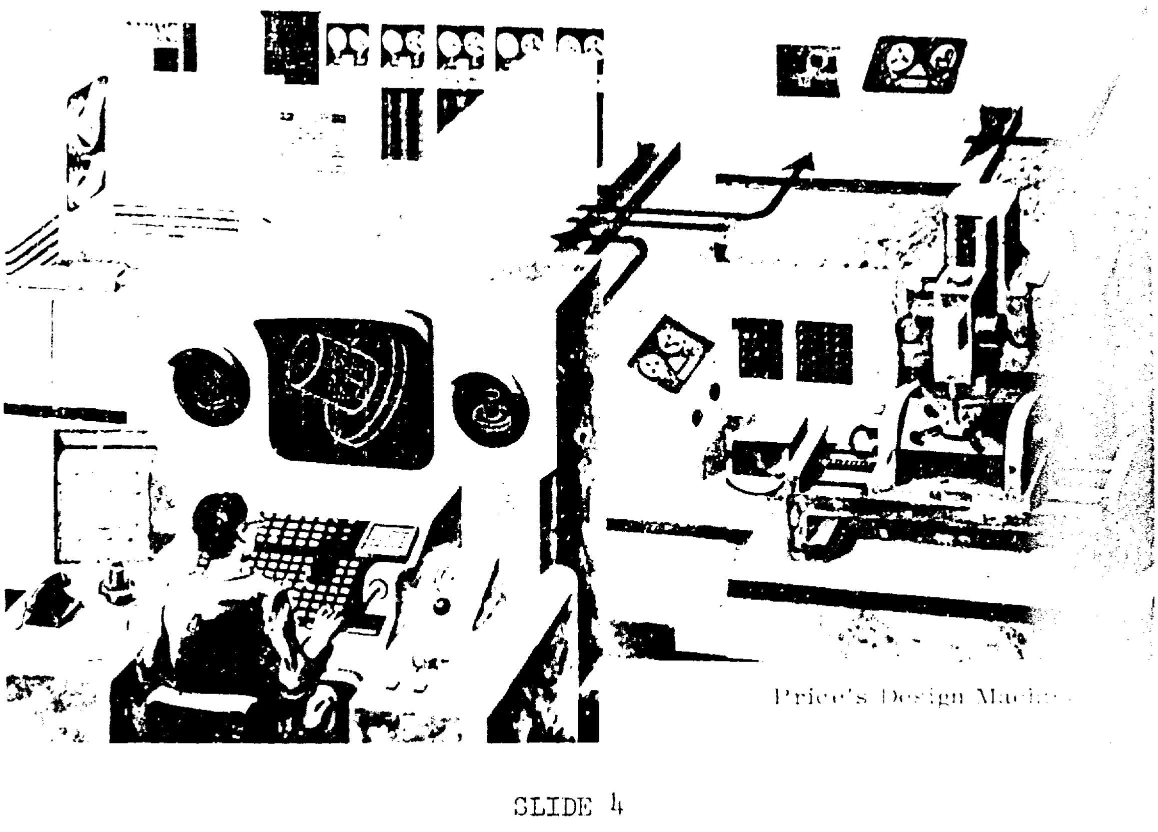
SLIDE 2

N. C. EQUIPMENT

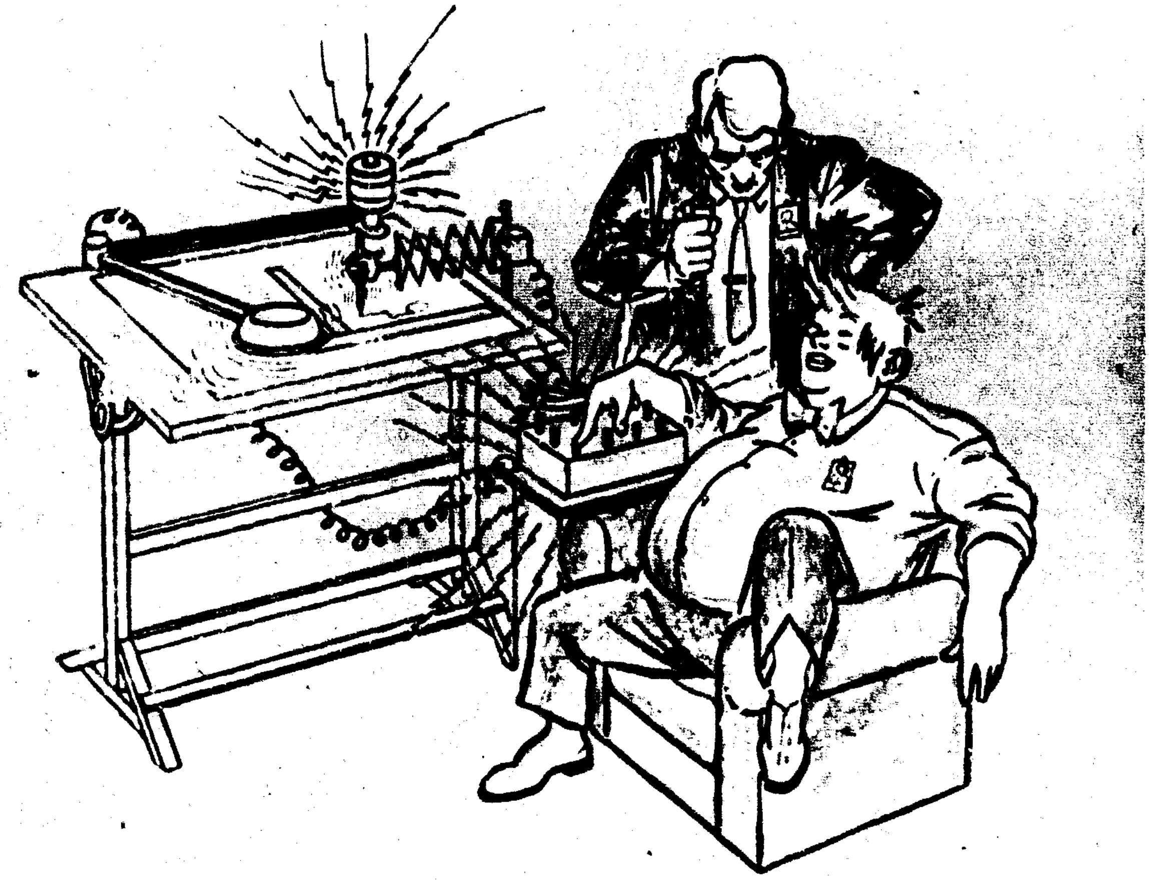
ADVANTAGES TO ENGINEERS AND DESIGNERS

- CONSISTENT TOLERANCES
- CLOSE TOLERANCE AT LOWER COST
- INTERCHANGEABILITY OF PARTS
- MORE DESIGN LATITUDE PER MACHINE CAPABILITIES
- ENGINEERING SPECIFICATIONS HELD

SLIDE 3



SLIDE 4



SLIDE 5

Traditionally, when a new model year car is produced, a substantial effort is devoted to the stylist's clay model. From this model, thousands of man-hours are required in preparing drawings and templates for checking style lines and contours. Additionally, a carved mahogany model and tracer masters are generated from this clay model. Finally, from these masters, a set of body dies must be cut by large milling machines, which in turn bang out the stamped pieces. Now some auto manufacturers bypass much of the paper work and virtually all of the hand labor. A device similar to a TV camera studies body contours that were drawn from the clay model and translates them into computer language. Then a computer generates a tape that can be fed into a numerically controlled machine for producing the body dies automatically. Essentially, the body drawings are lofting drawings. Through the "digitizing" processes, the lofting drawings are placed on a table, and as the operator traces with the TV camera-like device, he punches a button for as many points as he desires--thus providing the required coordinates for the computer. In turn, the computer produces the tape which controls the manufacture of the die.

The description of this process is dramatic because it is close to home to those of us who run Rivieras, Pontiacs, Mustangs, etc. But the process is not exactly unknown to missile and aircraft manufacturers, the electrical equipment manufacturers, and even the bathing suit manufacturers! Do you know that one leading bathing suit manufacturer uses the styling pattern to click off the required coordinates into a computer which produces the tape to cut the suit pieces? From this single process, tapes for a number of proportioned sizes are also produced. Even men's suits are not immune to NC manufacture! One national manufacturer of men's suits is also exploring the process and predicts that its Fall suits will be produced by NC techniques.

I have cited these few examples of NC capability primarily to make the point that it is here today. If for no other reason, competition in the market place compels all of us to look hard at the process and to adapt it to the extent necessary to continue to prosper.

We all know that the Department of Defense is one of the staunch advocates of competitive procurement. Because of this it recognizes that the documentation aspect of NC manufacturing requires a substantial reappraisal of the current data preparation and procurement standards. While DOD is undergoing this reappraisal, it still imposes the same data requirements. Procurement standards must be revised by factoring in this new manufacturing concept; otherwise the total benefits of NC may not materialize. We will tend to bog down because of resistance to change. It is this situation that we should strive to avoid. Fortunately, there are signs that the DOD is getting ready to move in this area to provide the proper direction.

One fundamental consideration that we must face up to in this evolving technology is the need for joining of the minds of specialists in contract administration, engineering, manufacturing, quality control, maintenance and repair, etc. The diverse requirements of these specialists can no longer be segmented but must be more fully integrated. Since the engineering drawing serves as the catalytic agent, it follows that the procedures and standards dealing with the use or preparation of the drawing must be more responsive to the needs of these specialists. More about this later.

Some of the proposals that are advanced in this paper will undoubtedly be controversial and perhaps even unacceptable--but then any new concept is never accepted with complete equanimity. They are intended, however, to stir your imagination and, indeed, even to shock you! Moreover, these proposals are not intended to solve existing problems--rather to point the way for their possible reconciliation.

With respect to engineering data requirements for NC manufacturing capability, we are dealing with two fundamental premises. The first premise is that a certain amount of drawing as presently conceived will not be required as the techniques for preparing NC tapes from design layouts are refined. The second premise is that where the aforementioned is not desired nor practical, but where NC manufacturing capabilities will be used, certain other changes in procedures and standards for engineering drawings must be thoughtfully considered.

Let's analyze the situation. In the area of data rights, except for certain aspects that have not been completely reconciled, the basic standards concerning ownership need not change. Let's assume that a contractor who is geared for NC manufacture was successful in a contract award. Further, let's assume that the data rights which developed belonged to the Government. Under the present regulations, in all probability full design disclosure would be required. However, the contractor will not require the complete documentation package because he can produce many of the piece parts directly from a layout which embodied the basic design! Alternatively, the contractor would be required to prepare documentation to the fullest extent, even when he really needs a small part of the data or must regenerate it in response to his NC machine requirements. Under present regulations the Government would require the complete package, even if deferred delivery is invoked. Thus, in effect, the Government will have bought insurance which in all probability would not be needed and raised the cost of the product which the NC process was intended to reduce! Presumably, since all of the conventional drawings were not required by the contractor and NC types were required, the Government will reimburse him for those which were recreated or replaced by the tape, so to speak. But why should the Government require the complete data package to support competitive reprocurement? Since the NC tape can be converted into digital form, why can't it be considered as part of the design disclosure? Granted, that at present, few can decipher the digital printout, but it does represent the engineering definition in a form not covered by conventional standards! In a manner of speaking, the situation is analogous to that of microfilm copy, which was never considered as admissible evidence in court until it reversed itself and now accepts evidence in such form.

But let's assume that DOD did agree to accept NC tapes from the original manufacturer. Under the prevailing climate, there is a common language barrier--i.e., tapes are not interchangeable between different producing equipments. The Government would be committed to sole source procurement in certain instances. Some abhor the idea, yet if you stop and think about the competitive aspects of NC manufacturing, the Government should obtain the material at less cost than if procured competitively where parts so procured were manufactured by conventional methods.

Business Week recently reported that "companies doing business with the Defense Department are about to get a long-sought break--fewer Government controls over contracts." The Pentagon says it believes that Industry, properly motivated, can control its costs much more effectively than Government personnel. With the variety of incentives and controls already in place, I fail to see why sole source procurement would not be advantageous to the Government if Industry were properly motivated.

Now let's assume that there is a need to manufacture a part which was originally procured without benefit of drawings at a Government repair base facility. Obviously, unless NC manufacturing equipment that would accept the tape furnished to the Government by the design agent were available at the base, remanufacture would be difficult and perhaps impossible. Much depends on the complexity of the part and personnel resourcefulness. One possible solution would be to impose an obligation on the original supplier to be responsive to this situation for the duration of the life of the product. Since the rate of obsolescence for defense equipment is higher than for industrial products, this obligation would not appear to be unrealistic. Because of the quick turn-around capability of NC equipment, the manufacturer should be able to supply the occasional part quite rapidly--especially since specialized tooling is not generally required. Perhaps the Government will pay a premium for such occasional service. Is it not worth the price if its needs are assured prompt attention by the manufacturer? The collapsing of time and the cost of lost motion inherent in the reprocurement cycle will be more than offset by any such premium. Another solution might be to do a more sophisticated logistics job in procuring spares.

On the subject of logistics support, the normal procedure, as you know, is to hold a joint Government/supplier conference to arrive at the best decision for the procurem[illegible] spares. This involves the review of an extensive number of drawings. [illegible] ome of the drawings have been replaced with tapes, the decision-making [illegible]s would be hampered unless substitute means are provided for the review. A possible consideration might be to include in the review, photographs of "drawingless" items--or even the hard items if they are amenable to such action. If the hard items are not available, perhaps the prototype items will suffice.

Consider the small supplier who cannot afford sophisticated NC manufacturing equipment. He argues for continued use of conventional drawings. This means that ways will have to be found for managing the data in conventional form and in NC form. More about this later.

Let's look more closely at the documentation of an item produced by NC methods. Since the tape in essence is the drawing, it must be identified in the usual way. The ancillary information such as material, finish, and feature controls where required, could be recorded in a small and simple outline-type drawing that would be the governing document. This document must also pick up a reference to the tape. Of course, much of this information could also be coded on the tape where standard materials and finishes are to be used. However, the coding must be standard. It may even be necessary to put greater emphasis on use of maintenance-type drawings in the field, as the tape will not be an asset to the maintenance crew. Even technical publications may need to be expanded for better maintenance information.

The revisions to NC tapes are comparatively easy to make. The problem lies in splicing the revised NC information at the proper point. A solution must be found for the control of the revisions to the tapes. One possibility is to place greater emphasis on the Engineering Change Notice. Any why not, since it must be produced in all instances of change? Why, then, can it not become a permanent part of the basic outline drawing on which is recorded the ancillary information pertaining to the part? Another possible solution to the ancillary information might be to prepare a composite listing of parts, much like a numerical index, and include the related information against each part listed. A tape could also be furnished which would accomplish the same thing as the index, much like the magnetic tapes that most large multi-division companies furnish to the Internal Revenue Service or the Social Security Board on payments to or deductions from salaries of its employees. There are numerous possibilities.

The question may logically be raised as to what percent of the total engineering drawings annually procured by the DOD does fall in the category of dimensionless drawings. This is a difficult question to answer with any assurance. Potentially, almost half of the drawings produced in conventional form could become dimensionless-type drawings. The reason why there has not been any substantial move in this direction is that Industry is just beginning to get the feel of the situation for using NC equipment. But this should not deter constructive action for establishing guidelines or standards for ultimately broadening the base for use of dimensionless drawings.

Now let's look at the documentation aspect of NC drawings. I don't believe that many of us would disagree on the basic purpose of an engineering drawing. In fact, we can generally conclude that it's because of past and present agreement as to what really belongs on a drawing that standards and regulations relating thereto have been generated and are implemented in current contracts. However, NC manufacturing, at least for the interim, poses some interesting problems which must be met head-on if we are to progress and take full advantage of the overall opportunities it provides. We have got to change some of our thinking about engineering drawings. We've got to think of them as business documents and therefore as part of our respective business systems. In certain cases, the manufacturing function may require additional data on the drawing to facilitate the part programing, even though such data may not be essential to the engineering definition of the part. For example, if a parabolic-shaped part will be produced on NC equipment only, then only the equation of the curve is required, along with the beginning and ending of the tool location. However, if the part may be made by conventional manufacturing processes and NC methods, then it may be desirable to give a complete X-Y plot of the parabolic curve. Thus, the curve is dimensioned in both forms--or double-dimensioned, if you will. This sort of thing may be repeated with greater frequency than in the past. The reason for this is that for the interim, one cannot accurately determine if--because of machine loading considerations--the part is to be made on an NC machine tool or a conventional one.

Let's get more inquisitive about some of the detailed practices that may need to be observed when preparing drawings suitable for use on NC or conventional manufacturing equipment, so that the part-planning process may be simplified. Manufacturing machines which are automatically controlled by tapes and other control media represent considerable investment. They can be costly to operate if the translation of the drawing to a machine instruction is complex or incorrect.

To assist the manufacturing function in making optimum use of machine time, when drawings are used, they must present required information so as to: (SLIDE 6.)

1. Facilitate preparation of control media in the most economical form.
2. Maximize repetitive usage of standard features produced by tools such as drills, reamers, taps, punches, cutters, etc.
3. Align features for minimum tool or table motions.
4. Minimize variety of tools per setup.

Therefore, preplanning consultation with the manufacturing function is almost a prerequisite prior to release of final drawings.

To facilitate information input into control media, the Decimal Inch System should be used. Fractions should be avoided as they may require extensive conversion with attendant errors, or may require establishment of additional costly machine conversion programs.

In general, nominal dimensions should be used for location of features such as machined surfaces, holes, slots, etc. The tolerances for the location of such features should also be expressed in decimal form.

Feature sizes of holes, slot widths, etc, which are determined by tools such as drills, end mills, etc, should be expressed as max/min. Feature sizes for turned diameters, slot widths produced by repeated passes of a tool programed in the tape, and depths of features should be expressed as nominals with tolerances.

Due to fixturing simplicity inherent with numerical control equipment, cast, forged, or fabricated parts may require machining pads, bosses, or lugs.

GENERAL DRAFTING CONSIDERATIONS

1. Preplanning consultation
2. Repetitive use of standard tools
3. Principle views as viewed by machine
4. All dimensions on the delineation or in table
5. Decimal inch system
6. Nominal dimensions for location of features
7. Delineate features for fixturing and set-up
8. Rectangular coordinate dimensioning
9. Tolerance based on design needs
10. Datum dimensioning

SLIDE 6

Such features should be delineated upon request from manufacturing. They shall not be considered as part of the basic design and should be designated for the purpose intended.

When a hole pattern is normally defined by rectangular coordinates or by true position location, and a computer assist program is used to produce the part, additional dimensions for machine compatibility may be required which normally would not have been given. Normally, reference dimensions do not govern manufacturing operations in any way. When used in conjunction with numerical control operations, they are useful for preparing the machine tape. Such dimensions must be accurate to preclude manufacture of the part outside of tolerances already given for convensional manufacture.

The foregoing are representative of a number of other detail practices which must be reexamined in view of the new method of manufacture. This further suggests that a number of changes may be in order throughout the various standards. (SLIDES 7 and 8.)

Translating some of the points we have discussed into actual graphical presentations, I believe that the following slides--which were forerunners of drawings now being used in General Electric--will be of interest. Slides 9 and 10 show the casting and machine information of a part of average complexity. Slide 11 is the NC drawing of the machine information previously shown. Slide 12 shows how the feature controls can be applied to an NC drawing. If you have never seen a part planning sheet, Slide 13 illustrates what we are using in General Electric. The foregoing is illustrative of what can be done to simplify the combined engineering and part planning documentation. It clearly illustrates

PRIMARY DIMENSIONING CONSIDERATIONS

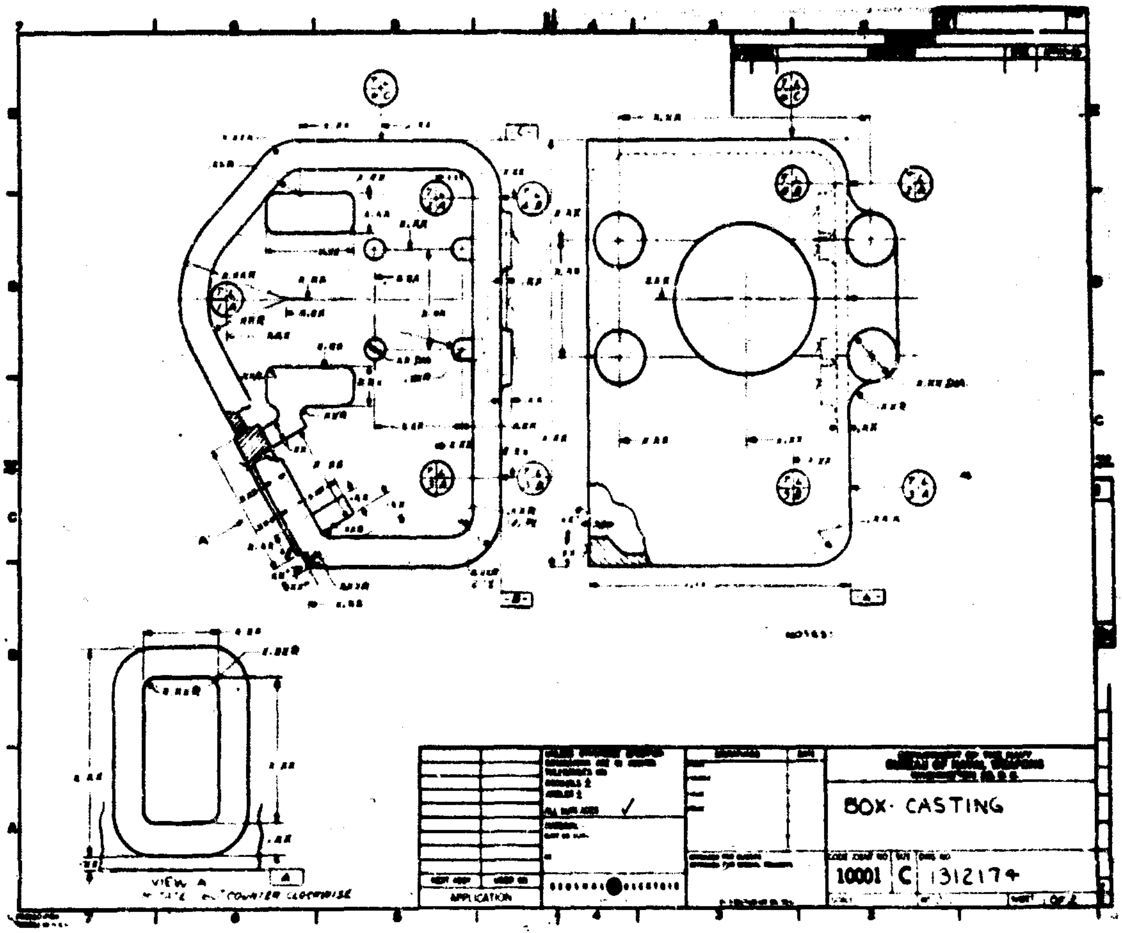
1. BECOME ACQUAINTED WITH THE MACHINES
2. TAKE DRAWING DIMENSIONS FROM DATUM SURFACES
3. DELINEATE EACH PRINCIPAL SURFACE
4. USE DECIMAL DIMENSIONS
5. USE RECTANGULAR COORDINATES
6. HAVE PRINCIPAL SURFACE FACE VIEWER

SLIDE 7

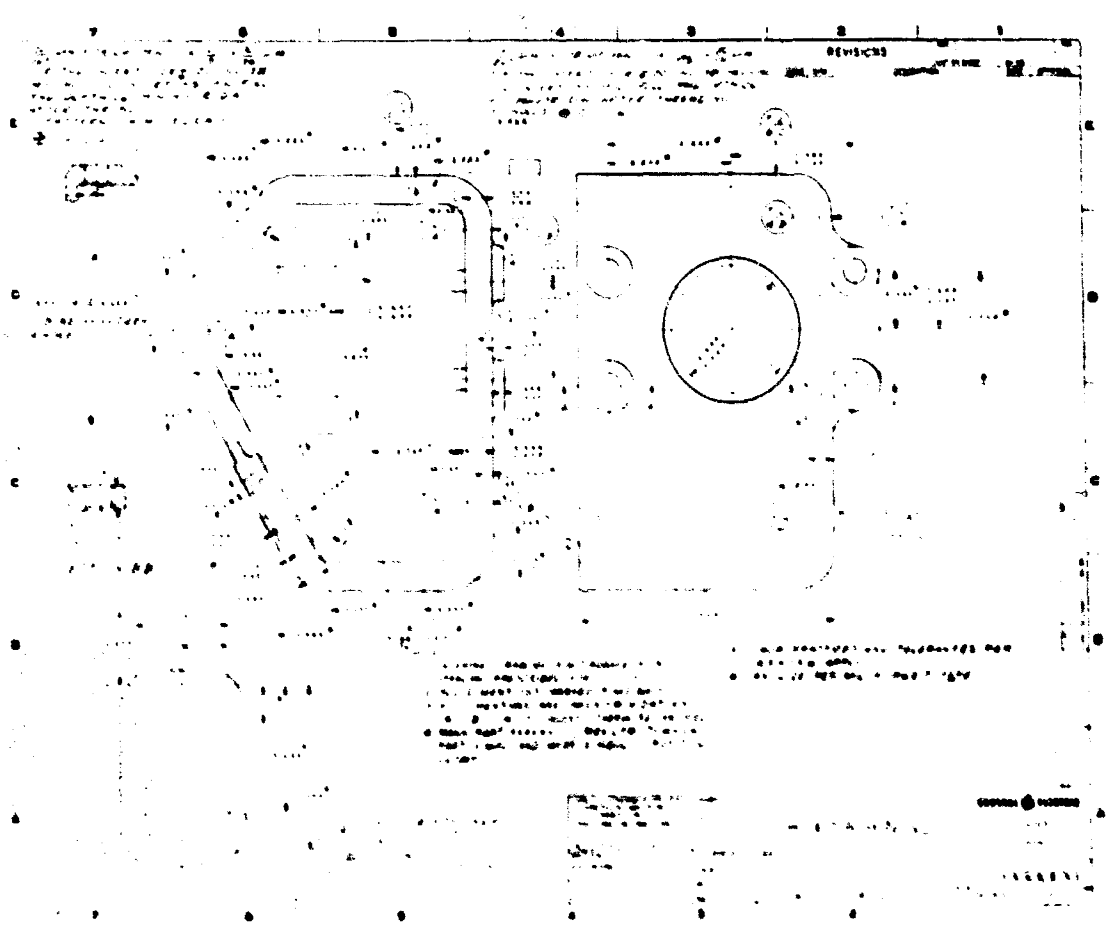
SECONDARY DIMENSIONING CONSIDERATIONS

• DEFINE STRAIGHT LINES	– END POINT COORDINATES
• DEFINE ARCS OF CIRCLES	– END POINTS, CENTER RADIUS
• DEFINE SLOPE	– END POINTS, ANGLE
• FIXTURE REQUIREMENTS	– ROTATION OF DIMENSIONS

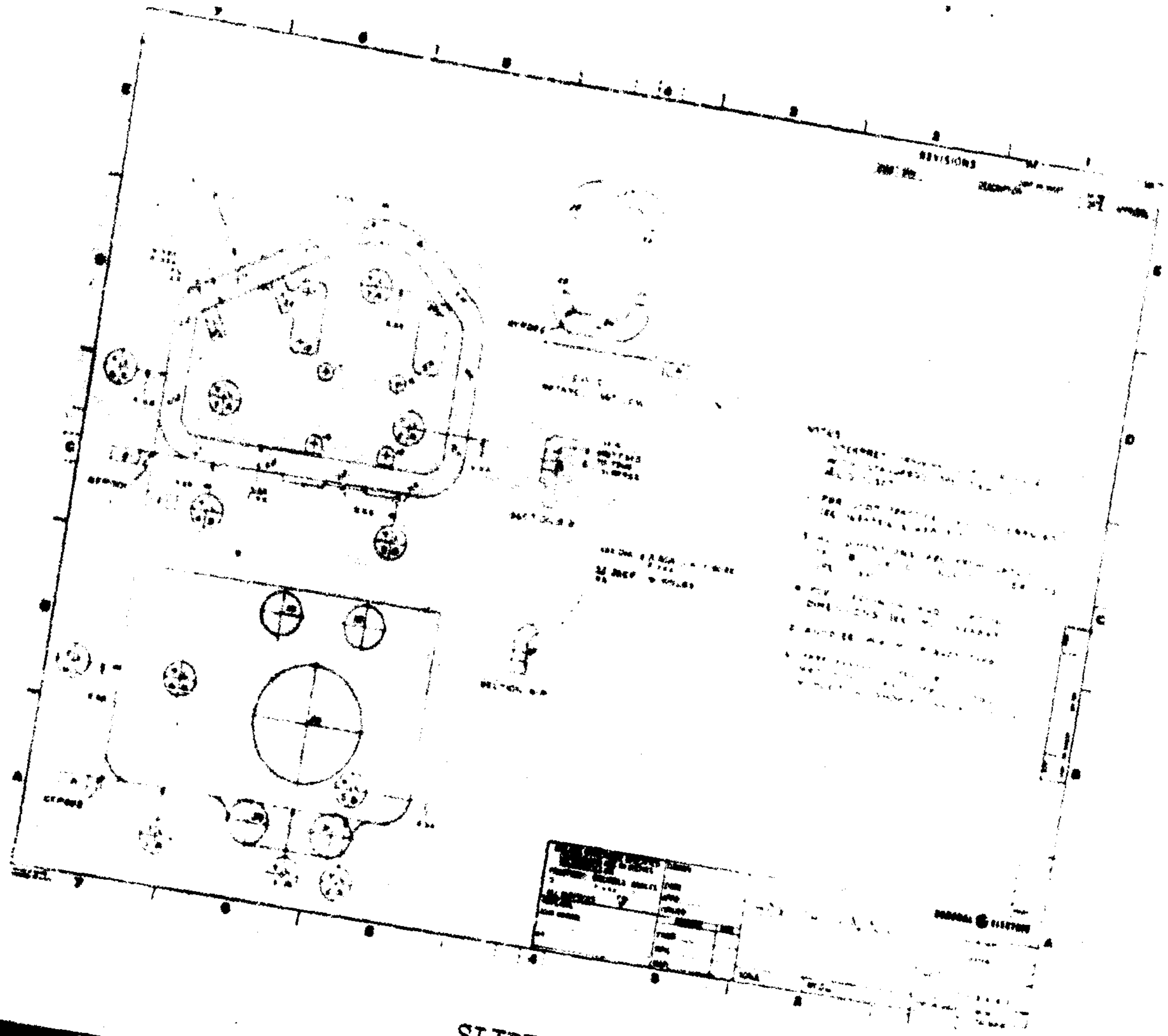
SLIDE 8



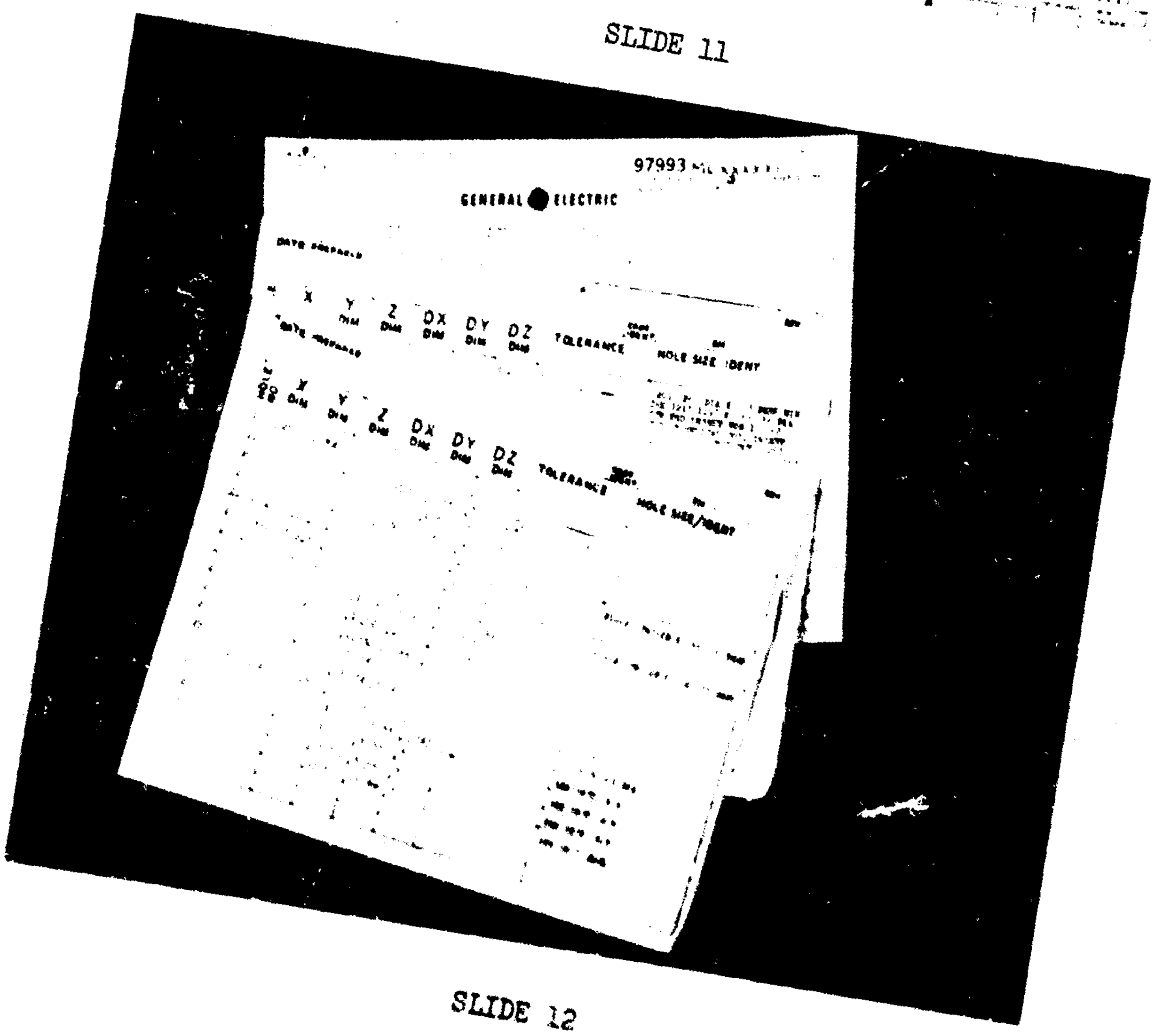
SLIDE 9



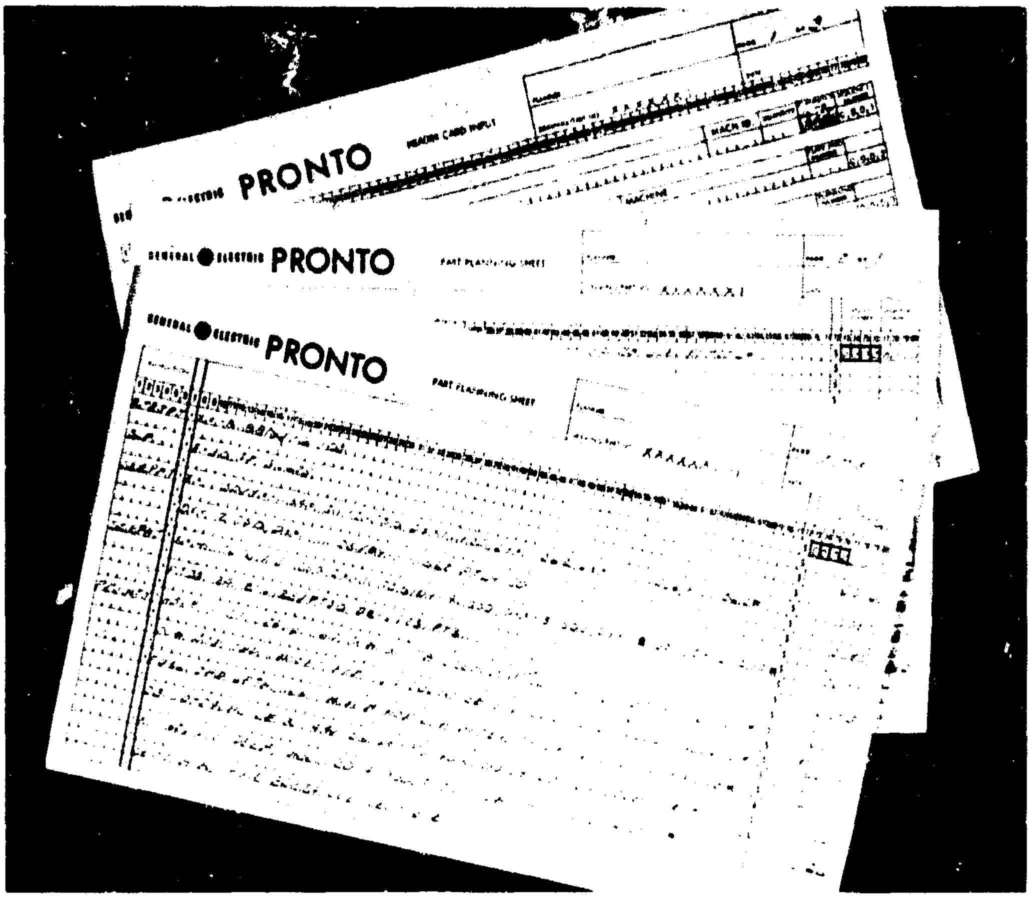
SLIDE 10



SLIDE 11



SLIDE 12



SLIDE 13

a radical departure from the conventional documentation to which we have been accustomed.

The Air Force has begun to recognize some of the NC documentation problems that we have reviewed so far. They realize that there is an urgent need for the development either of a common language or an interpretive device that will accept an NC tape in one form and regenerate it in another. While development appears to be in the distant future, the Air Force realistically acknowledges that it must do something for the interim while not encumbering progress in the state-of-the-art. The Air Force is contemplating soliciting from industry complete part planning information exactly as produced by the manufacturer. Through this technique they would hope at least to obtain some assurance that in the event of insufficient technical data, it would have some manufacturing information to permit it to produce the "drawingless" item. It appears to be more of a stopgap for a breather, while watchfully waiting and simultaneously prodding industry into action in the common language area. In time, I believe that the problem of common language tapes will be solved, but meanwhile we've got to be smart enough to deal with the nonuniform aspects of the situation. We can draw a parallel in this instance to the microfilm problem which existed approximately 10 years ago. You will recall that at that time consideration was being given to standardize on 8-, 16-, 35-, 70-, and 105-mm microfilm. On one side of the fence we had the card and automatic machine sorter manufacturers, and on the other side, the microfilm viewing equipment manufacturers. There was considerable controversy on the merits of the various combinations--and it was not until the military stepped in with its requirements that the microfilm and PCAM card standards we now work to were finally evolved. Their effect on Industry as a whole is now anticlimatic.

The foregoing are typical of the problems we in Industry are just beginning to face up to. We believe that the Government should also be interested in these matters to the extent that we are because, after all, there is only one source for the tax dollar.

There are many facets of these problems yet to be explored. Some of these will be quickly resolved and others will be tougher than we think. The point is that there is time to think and act logically on these problems if we do it now. Then the process could be evolutionary and not revolutionary. Otherwise somebody will push the panic button and poor standards and regulations may result.

The problem of phasing from the old to the new invariably creates some dislocations. However, such situations offer greater opportunities for improving the lot of many. We have this opportunity today if we will act upon it with dispatch.

QUESTION and ANSWER SESSION

F4

Moderator:	J. S. Crawford
Panelists:	P. H. Daggett, Jr. P. R. Durr R. F. Franciose C. S. Mobley W. W. Thomas for Mr. Schnabel

QUESTION — What is meant by redress?

MR. THOMAS for MR. SCHNABEL — This division had a whole series of contracts that started out with rather loose drawing requirements for best commercial practices. Over a period of years the contracts have changed to become rather strict military specification compliance practices. What we mean by redress was fixing up the best commercial practice drawing to make it acceptable to the latest particular contractually required specification. This is not a redraw, it is just the improving legibility and up-dating specifications type of operation needed to convert commercial practices to military.

QUESTION — Is there any indication of how much use of the numerical control equipment is being made now?

MR. FRANCIOSE — There is not an easy answer to this one. Every manufacturer who is sensitive to his cost problems is either investigating NC equipment or is negotiating for his purchase or lease. It offers so many more advantages over conventional manufacturing facilities. The problem is equipment already in place needs to be amortized. We do have an incentive wherein certain equipment may be amortized within a seven year period, I believe. I believe that it will be at least five years before you will see any real conversion to NC manufacturing equipment.

QUESTION — How do you handle this information if you are going to produce the part in one instance on the drill press, another instance say on a jig bore or a Weideman press, both of which produce the same part.

MR. FRANCIOSE — As far as any additional information is concerned which you might require, that should pose no problem. It becomes a question of part planning processing, as I see it. However, let's keep in mind the fact that a drawing prepared for NC

MR. FRANCIOSE (Continued)	manufacture usually lends itself to conventional manufacture more readily than vice versa. If a supplier is involved as an extension of your manufacturing facility, I would say that you can handle this in several ways. You can prepare a multi-sheet drawing covering the various processes, however, this will raise some problems and is generally not the best practice. On the other hand, you can prepare the drawing such that the engineering definition is complete. The part programmer or planner can prepare the required part planning process sheets to cover both kinds of manufacturing equipment, viz., conventional or NC type.
QUESTION	You have to have standard dimensioning for the drilling operation and then you also have a tape for the drilling portion of it. Is this correct?
MR. FRANCIOSE	Yes, you do have to prepare a drawing with standard dimensioning. This information is then converted into 8-channel or magnetic tape for use on NC equipment. This conversion is done by the part programmer or planner.
QUESTION	Was there any further review or inspection or check of deliverable drawing in your system other than made by design checker?
MR. MOBLEY	The only review of deliverable documentation other than the detailed inspection made by a resident customer representative. He has the authority, by contract, to go as deep into the documentation as he deems necessary. His review, however, usually consists of just a look at the financial and logistic impact of the documentation package and its E.O. paperwork. There is also an inspection of the quality of all microfilm that is shipped to the different agencies of our customers. The detailed inspection of the design and documentation by Martin design checking is normally more than sufficient to satisfy company and customer requirements.
QUESTION	Are there any photo drawings being microfilmed and the resultant microfilm submitted to the military?
MR. DAGGETT	At the Naval Air Technical Service facility we are receiving copies of engineering drawings made as photographs on microfilm. There is

MR. DAGGETT (Continued)	not a great deal of it but there is enough of it. It has posed problems here and there.
QUESTION	How about the Air Force?
MR. DURR	It is the same as described by Mr. Daggett.

G1 STEPPING STONES TO SPACE EXPLORATION

Address by Mr. H. Hueter to the Annual Banquet
Engineering Documentation Section of the
American Ordnance Association

It is a pleasure for me to appear here tonight on behalf of General O'Connor and Marshall Space Flight Center. General O'Connor, who is Director of Industrial Operations, was called to the West Coast on business. He had been looking forward to speaking this evening, and to spending some time in the famous Florida sunshine.

I was happy, however, to accept in his place the invitation to speak to you during this, the 8th Annual Meeting of the Engineering Documentation Section of the American Ordnance Association.

We at Marshall salute you for the tremendous work you are doing in the documentation area.

This is a field not always given sufficient recognition and appreciation for the valuable role it plays in getting the job done. Incidentally, even in the days of the early flying machines, documentation was considered an important part of the contract.

To prepare this speech, I did some homework in American History and discovered that in 1908 the Wright Brothers were awarded a contract by the Signal Corps. to furnish the Army with a flying machine. Included as part of the contract was a clause requiring documentation-

scale drawings
top speed
wing surface
and component descriptions

Likely this was nothing more than the few working papers the Wright Brothers had assembled during the few years they had worked to conquer the problems of air travel.

Of course, communications then were simple and usually direct. More often than not, the engineer, draftsman, mechanic and test pilot were one and the same. There were no interface problems to overcome due to widely scattered manufacturing plants and sub-contractors.

Since that time when aircraft technology was trying to get the speed of the craft up to 40 miles per hour, communications and interface problems have increased enormously. Documentation has grown accordingly - in size as well as in complexity.

Now, almost 60 years later, we find ourselves literally covered up with program plans, reliability plans, test plans, procedures, specifications, drawings, directives, reports, etc., which must be read, reviewed, evaluated, signed, sent forward, and implemented.

In the Apollo Program where I am coming from, the magnitude and complexity of the task accentuates the need for efficient documentation. The three Manned Space Flight Centers - Marshall Space Flight Center, Manned Spacecraft Center, and Kennedy Space Center - together with approximately 35 major prime contractors, are building a system of launch vehicles, spacecraft, ground support equipment and launch facilities. These systems merge for the first time on the launch pad. Without a most meticulous documentation system throughout, this would be impossible. With the tremendous number of people involved there is, of course, great danger of going overboard and generating a bottleneck rather than an effective and frictionless control. Therefore, a determined effort must be made to continuously monitor our data systems. Dollars which can be saved in our program, or otherwise wasted, run into millions.

Therefore, we must continuously coordinate our efforts, trim and simplify our documentation requirements, yet in doing so, remain alert not to leave serious gaps in essential data.

Mr. Lamonte Goldston, this afternoon, described to you how we in Marshall Space Flight Center try to control it and what we were able to do about it. Just as communication and interface determination are essential to effective management, so is a system to prevent unnecessary complications.

Groups of experts such as you here tonight who have realized this are working tirelessly to overcome these problems are vital for today's large and costly programs.

As General Schriever said in his keynote address to the Air Force/ Industry, Data Management Symposium last year, "Decisions are the basis of management, and data are the basis of all decisions."

When I was asked to come and talk to this group, I wondered what I could say other than to assure you of Marshall's interest and support of, your association's activities.

It was suggested that possibly the group would be interested in some of the accomplishments in the space program and some of our plans for the years ahead.

This last year has been particularly successful for NASA's Manned Space Flight team. A team consisting of our Washington Headquarters, field centers, prime contractors and subcontractors from industry.

This past year, in the Gemini Program, the spacecraft was flown six times - once unmanned and five times with astronauts. Time spent in space grew from 1½ days with the final Mercury flight in 1963 to 14 days by the end of 1965.

From every flight, the astronauts returned to earth in excellent health - perhaps a little shaky from Gemini 8, the latest shot. But, still physically and mentally okay. Rendezvous with the Agena target vehicle was accomplished with Gemini 8 and our alternate pickup and recovery operations tested without flaw.

1965 was also the year of the space walk by Ed White - proof that man can operate outside the confines of his spacecraft.

Furthermore, 1965 was the year we sat before the television screen and watched as photographs of the moon and of Mars were relayed from outer space. All these were steppings stones to the largest research and development program this country has ever undertaken- the Apollo Program.

Now, what progress have we made in the Apollo Program, the program that follows Gemini?

In 1965 the first phase of the Saturn launch vehicle program was completed. In ten flights of the Saturn 1, ten were successful. This is an unprecedented record of success in rocket development. The research and development phase was completed with the launch of the sixth vehicle and the remaining four vehicles were declared operational. Pegasus satellites were placed in a near-earth (SA-9 310 X 465 miles, SA-8 273 X 420 miles, SA-10 286 X 287) orbit by the last three Saturn 1's. The Pegasus satellites you might remember are being used to explore the hazards of meteroids in outer space. Results have confirmed the predicted frequency of possible impact in relation to the spacecraft.

Much of the technology required for the later Saturn launch vehicles to be used in the manned Apollo Flights was proven out in the Saturn 1 Program. This includes the guidance system, clustered or multi-rocket engines concept and the use of liquid hydrogen as a rocket fuel. The latter is most important as it provides us almost double the fule economy of earlier fuels.

The first stage of the 2-stage Saturn 1 was built by Marshall except for the last two which were built by the Chrysler Corporation. Douglas Aircraft Company was contractor for the second stage. The first time flown on the fifth Saturn 1.

The major milestone we had set as our goal in 1966 was accomplished in February of this year. This was the first flight test of the Saturn 1B Launch vehicle. In this flight we introduced a new concept in our flight test philosphy. We call it the "all-up" concept. Both stages of the launch vehicle, a complex instrument unit and the spacecraft were all flown together for the first time. You can well imagine what was required in the way of an interface documentation effort to reduce the potential danger connected with such a first flight. While this increases the risks, the method however enables us to get more test results with fewer flights.

A second Saturn 1B is poised now on the pad at Kennedy Space Center here in Florida and stages for a third one are being prepared for erection. Both will be flown this year.

Our next major milestone will be a manned flight with the Saturn 1B vehicle in 1967.

Chrysler and Douglas again are building the first and second stages while the instrument unit, which carries the guidance and control system, is furnished by IBM. The spacecraft is the responsibility of NASA's Manned Spacecraft Center, Houston, Texas. It consists of the Command Module, which carries the 3 astronauts, the Service Module, which is a space propulsion system, and the Lunar Excursion Module.

Unmanned flights of the spacecraft and the Saturn V, the launch vehicle for the actual lunar flights, are planned for early 1967. With the Saturn V we will have the capability of placing in orbit payloads wieghing almost 300,000 pounds - approximately the equivalent of one Boeing 707 jet (or, almost twice the weight of all NASA's orbiting satellites, deep space probes, Mercury and Gemini Spacecrafts launched to date).

By 1968 we will begin manned flights on the Apollo-Saturn V, the final stepping stone to our goal of lunar landings.

Ground testing of all three Saturn V stages is virtually complete. Our prime contractors - Boeing for the first stage, North American Aviation the second stage, Douglas Aircraft the third stage, and IBM for the instrument unit, are making excellent progress in development and manufacture of the Saturn V vehicle. Equal progress is being made by the spacecraft contractors under the direction of Manned Spacecraft Center.

A Saturn V has already been assembled at the Kennedy Space Center and will roll out of the Vertical Assembly Building within the next few weeks. This is facilities test or non-flight vehicle. However, it is significant as it will be the first time the stages and spacecraft have been assembled and checked out with the GSE and launch facilities. All Facilities necessary to support the program in manufacturing, testing, and launch are rapidly nearing completion.

We have arrived at a manpower peak of 300,000 people in the Manned Space Flight effort. However, only about five percent of the total are Civil Service. The bulk is contractor and subcontractor personnel.

The program is under control, working toward established program goals, and staying close to the cost guidelines established at the program inception.

Now, what will we have in return from the heavy investment our nation has made in this advanced technology? The safe landing on the moon and return of our astronauts will, of course, be most rewarding. Of more importance in the long run will be the then-established fact that man can operate for a long time in space and travel more than a 1/4th of a million miles, land on a heavenly body, and return to earth.

In addition to this, many so-called "spin-offs" have been realized.

The electronics industry has been revolutionized by micro-miniaturization required by satellites and spacecraft. The sophisticated use of computers on board of space vehicles and in ground testing has advanced the art of computers considerably, and is paying off in many other related and non-related areas.

Other direct benefits come in the form of:

wideband trans-oceanic communications, for example,

the Comsat Corporation, a commercial enterprise,

global weather reporting and forecasts,

all weather navigation service.

Very important also are the improvements and developments in our

metals,

alloys,

ceramics

and other materials required by the space flight program.

Impressive benefits in the field of medicine alone have been realized. From the space program the new methods, new techniques of monitoring the physical conditions of astronauts in earth orbit are applied to the watch care of nurses and doctors over their patients in clinics and hospitals.

In the field of education, the space program has been a stimulus throughout the country. Higher education is sought after by a large majority of our young people. We are continuously increasing our knowledge of man, the earth and the solar system at a rate never accomplished or dreamed of before. To enlist the very much needed help of the scientific and academic community, NASA has made funds available in the form of scholarships, fellowships, research grants; for research opportunities and new laboratories.

Thus, the space program, though very young, has produced and is promising manifold benefits.

The exploration of space is now an accepted fact of life. As Dr. von Braun has said, "The public no longer asks why explore space, but what do we do next?"

Space exploration has been accepted because of its demonstrated successes, which have been nothing short of fantastic. And these successes have been made possible by the science and technology of our times, especially in the field of rocketry.

As science and technology have grown, discovery has followed discovery at an accelerating rate. Although the achievements have been tremendous, the Golden Age of Science still seems to lie ahead of us. Science is still facing wide open frontiers in many fields: the atomic nucleus is becoming more and more enigmatic; the origin and structure of the universe are still shrouded in mystery; and the exact bodily functions of living organisms still evade complete understanding.

The frontiers of exploration are by no means closed. Man went to sea when his technology permitted him to do so; he ascended into the air when he was able to fly; and now, with our new science and technology, we are building transportation systems that will take men deep into outer space.

For some time after the Space Age began by the placing of unmanned payloads into earth orbit, there was considerable discussion over whether man himself would be able to live and function effectively in space for prolonged periods of time. The brilliant successes of the Mercury and Gemini programs have removed most of these doubts, as our knowledge and experience have increased.

Weightlessness is no longer a problem. Our astronauts have returned from orbit with no serious after-effects. We were also concerned at first about the possibility of meteoroids striking the spacecraft or the astronauts. Explorer and Pegasus satellites have given us enough information about the size and probability distribution of these particles to say that a meteoroid large enough to penetrate a space suit will strike an astronaut only about once in one hundred years of space walking.

The Apollo spacecraft will have adequate shielding to protect the astronauts against radiation from the most sever solar flare yet seen. But when an astronaut is outside the spacecraft on the lunar surface, he could be subjected to dangerous amounts of radiation if he were exposed for very long to the proton showers from high intensity solar flares. Since the lunar landing will take place during the most active period of the coming sun-spot cycle, it might be necessary for our first astronauts to limit their explorations on foot.

The photographs taken by our Ranger probes, and those returned by the Russians Luna 9 soft-landing vehicle, have told us a good deal about the moon's surface. Selecting a smooth landing site, without steep slopes, should be no problem. These photographs support our confidence that the design of the Apollo lunar excursion module is adequate to carry out a successful landing.

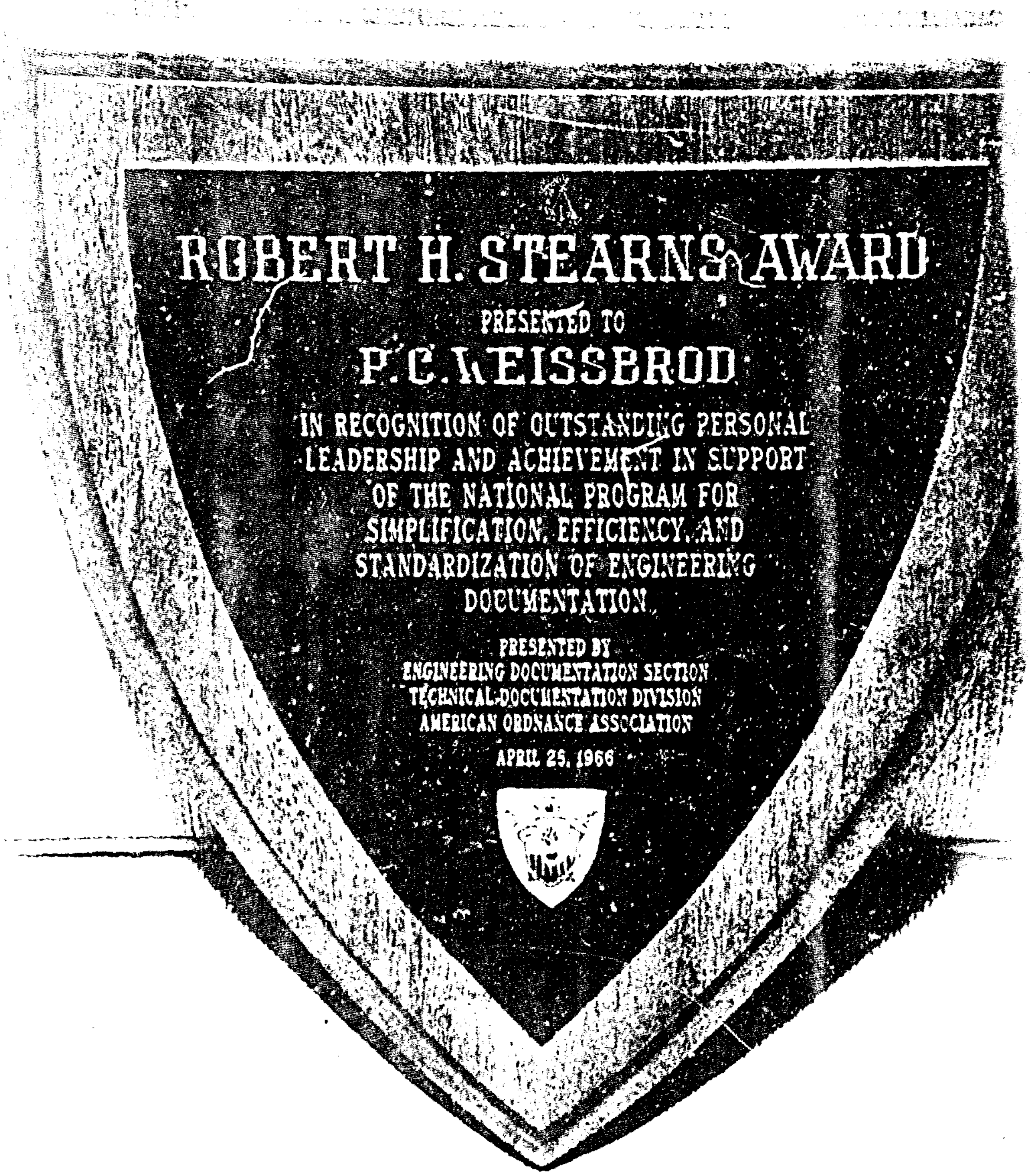
Still unknown is the bearing strength, or firmness, of the moon's surface. Some areas may be so loose and fluffy that an astronaut would have to wear snow shoes for walking about. Therefore, our next lunar probes will be made by the Surveyor soft-landing vehicles, beginning this year, to determine the firmness and consistency of the lunar surface.

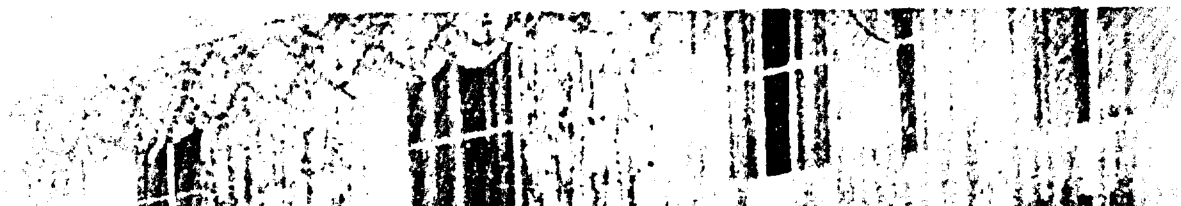
One of the much contested areas in present discussions of the space program revolves around the merits of unmanned investigations of space and the planets, compared with manned explorations. Some scientists argue eloquently that well-programmed instruments, with good telemetry, can tell us anything we want to know about conditions in the solar system, at less cost, and more effectively, than astronauts can. Manned space flight, they say, has produced little scientific results.

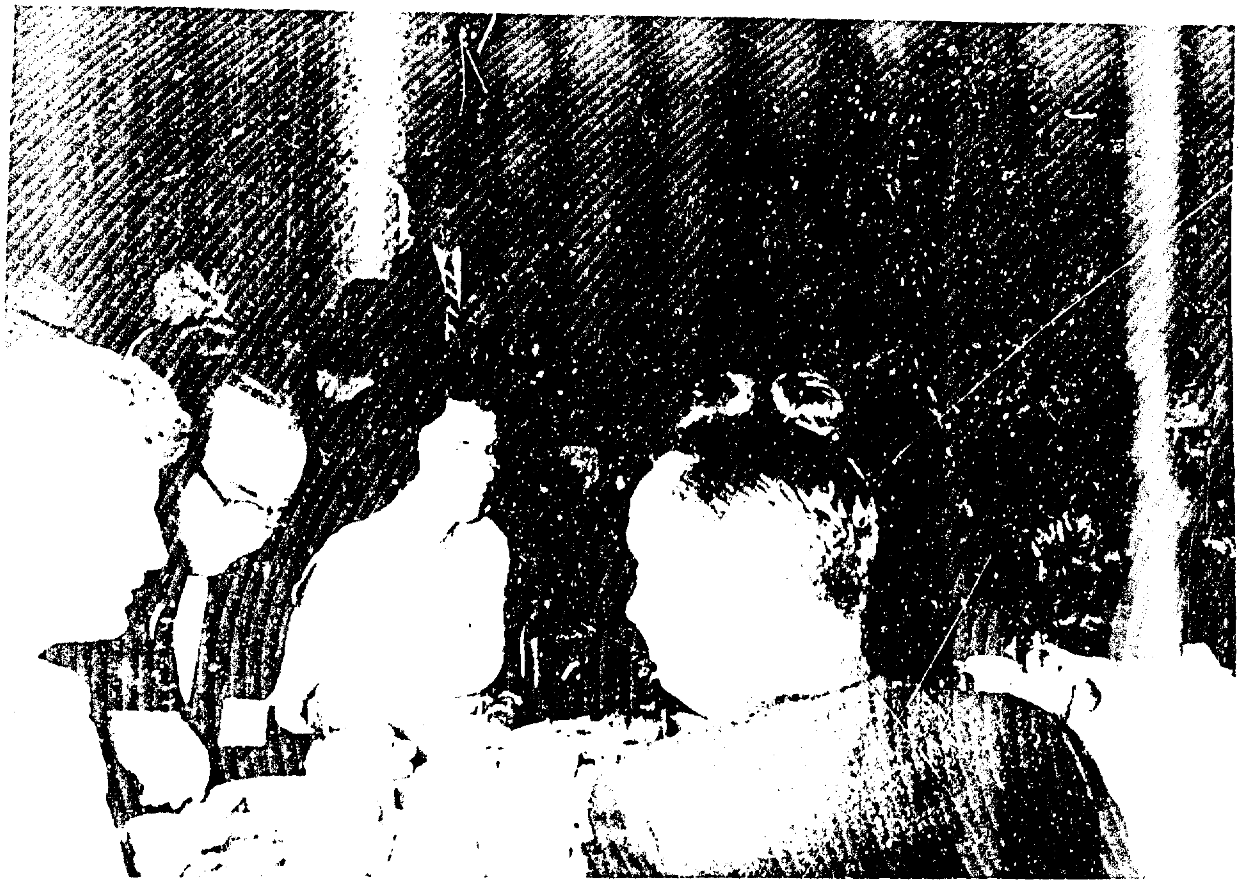
To say at this time that man in space has made little contribution to basic scientific knowledge would be like saying 20 years ago that atomic power can make no worthwhile contribution to humanity but has brought only death and destruction. We are just beginning to learn about space travel, just now developing the ability to explore space more deeply. So the nation's manned space flight program must be evaluated at this time on its potential - not on its demonstrated value. And believe me, this potential is quite promising.

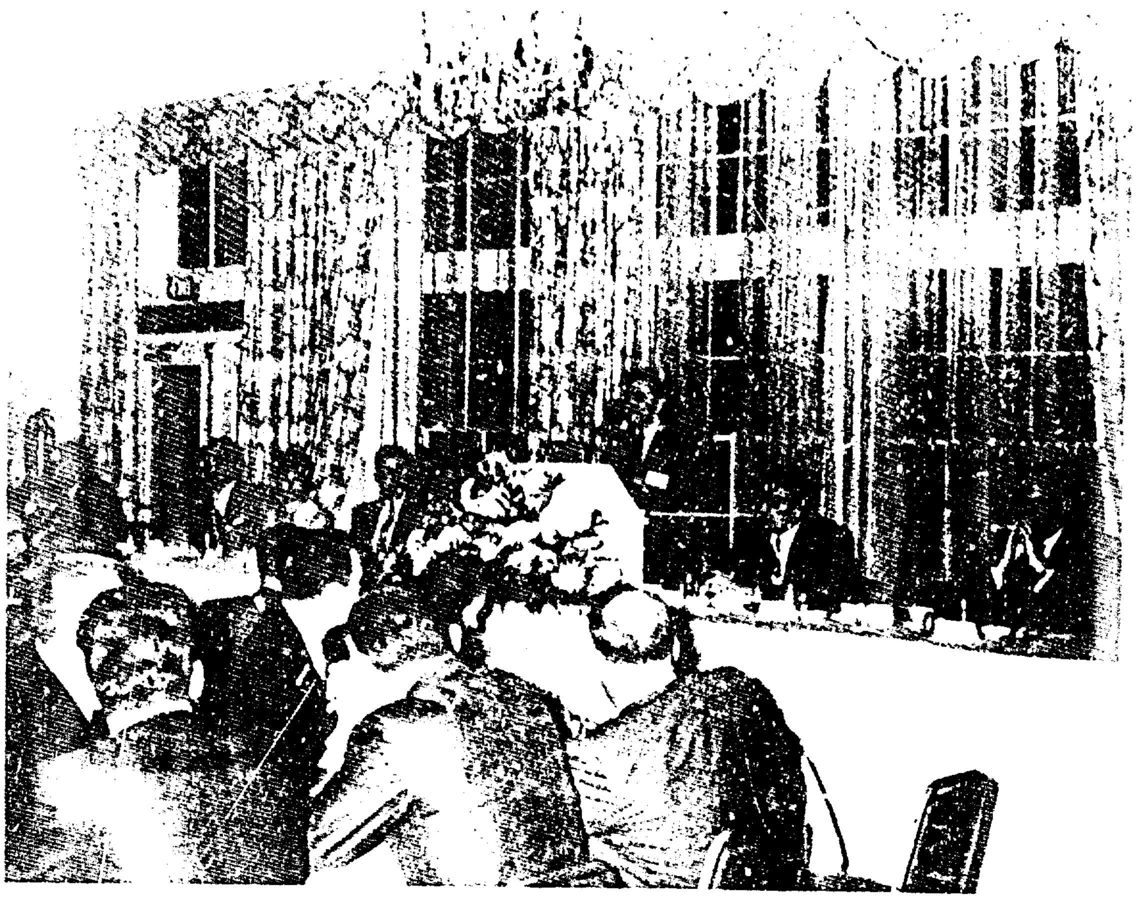
How many people in the year 1908 fully realized the potential of the Wright Brothers' Contraption? Who, then, fully comprehended the great promise of air flight? The number was small, but their accomplishments were many-each one a stepping stone to today's vast air transportation system.
We are today laying stepping stones toward space travel just as the Wright Brothers and others did 60 years ago.

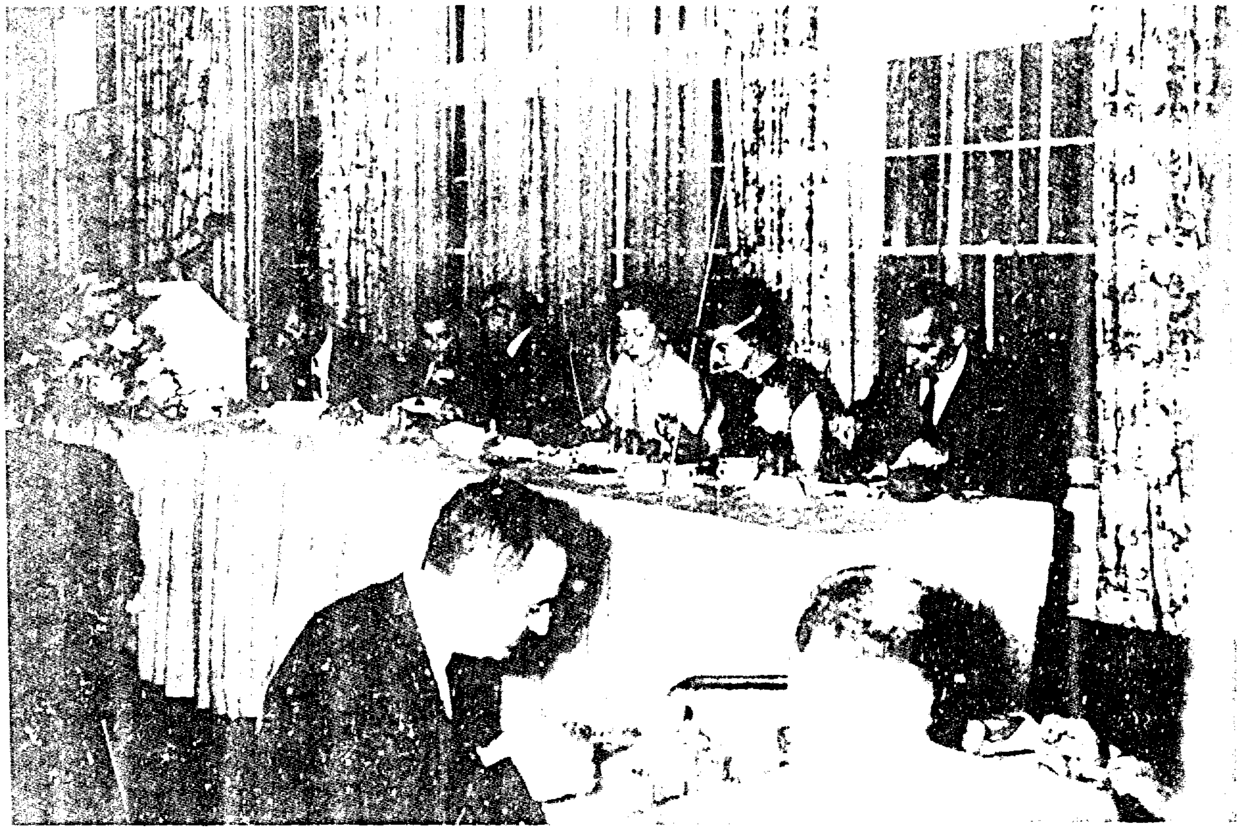
The lasting value of the current manned flight program will be the possession of a transportation system that will be able to take man far out into space. The new ability will push the frontiers of technology into areas considered 20 years ago, by most, as being strictly science fiction.


ROBERT H. STEARNS AWARD
PRESENTED TO
P.C. WEISSBROD
IN RECOGNITION OF OUTSTANDING PERSONAL
LEADERSHIP AND ACHIEVEMENT IN SUPPORT
OF THE NATIONAL PROGRAM FOR
SIMPLIFICATION, EFFICIENCY, AND
STANDARDIZATION OF ENGINEERING
DOCUMENTATION
PRESENTED BY
ENGINEERING DOCUMENTATION SECTION
TECHNICAL DOCUMENTATION DIVISION
AMERICAN ORDNANCE ASSOCIATION
APRIL 25, 1966









STEERING COMMITTEE STEERING

SOME ONES OUT !

SOME PRAYED

BOX LUNCHES ?

WE ASKED FOR
VOLUNTEERS

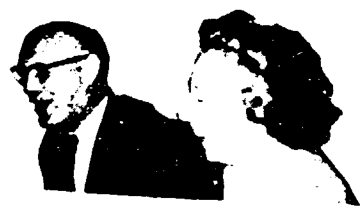
WE CELEBRATED ALL
SORTS OF THINGS !

HE WILL USE HIS
SHOE NEXT !

SHE'S A MEMBER ?

D-E-E-P CONCENTRATION

WHAT PAGE
WAS THAT ?



GO BACK TO SYRACUSE ??!

TO YOU, TOO!

About The Plaza

Daytona Beach Florida